An Empirical Analysis of Gender Bias in China

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Philosophy In Economics

August 2000

Abstract of thesis entitled:

An Empirical Analysis of Gender Bias in China

Submitted by Lui Kin Wai

for the degree of M.Phil. in Economics

at The Chinese University of Hong Kong in August 2000

With such a huge population, the population policy in the Chinese Mainland has impacts on not only herself but also around the world. The alarmingly increasing sex ratio at birth seems to be a consequence of the family policy and son preference. Other than the sex ratio at birth, relative mortality rate for infant females to males and the number of girl abandonment have also increased. To continue controlling population growth without unwanted consequences, it is important to analyze gender preference to find out the underlying factors and their magnitudes. In this paper, we explore the following question: (1) whether son preference really exists in the Chinese Mainland; (2) factors underlying gender bias and their magnitudes; (3) the impact of the population policy on gender bias.

With the data from Gansu province collected in the second phase of the Chinese Mainland In-depth Fertility Survey conducted in 1988, two econometric models using the desired sex of the next child and the difference in the number of sons and daughters as the independent variables are estimated. Results suggest that: (1) son preference does exist; (2) economic, social and cultural factors and the population policy have impacts on gender bias. The findings also suggest that there is a dilemma between population control and reducing son bias. With those findings, we have three suggestions. (1) To reduce the son preference, the

government should improve the education and social status of women, and establish a sound social security system as the long term objectives. (2) Enacting regulation against sex discrimination should also be considered. (3) In the short term, strict monitoring of peoples' fertility behaviors should be considered.

摘要

中國的人口政策在八零和九零年代減慢了人口增長，達到了二千年的人口指標，然而這並不是沒有代價的。在人口政策，尤其是一子政策，和傳統的兒子偏好(son bias)的共同影響下，出現了偏高的出生性別比、嬰孩死亡性別比和女嬰遺棄的問題。要繼續推行人口政策，減低其負面影響，有關兒子偏好的研究非常重要。敝論文意在找出兒子偏好是否存在、影響兒子偏好的因素及人口政策對兒子偏好有何種影響。

敝論文使用中國第二期深入生育力調查(1988)中甘肅的數據，建立兩個以兒子偏好指標爲被解釋變量的計量模型，來考查兒子偏好在中國的情況。結果指出，(1)兒子偏好確實存在; (2)經濟、社會、文化因素和人口政策影響兒子偏好; (3)人口政策和減低兒子偏好存在著矛盾。根據考查結果，我們認爲長遠來說，中國政府應改善婦女的教育和地位，建立完善的社會保障系統，並可考慮訂立反性別歧視條例。短期而言則應考慮嚴格監察生育情況.

Acknowledgement

I am grateful to Dr. Tsui Kai Yuen, my thesis supervisor. This thesis was hardly to be completed without his generous supports and valuable comments. I would also like to thank Mr. Kwan Wing Kai, Mr. Kwong Ho Man, Mr. Lam Kuen and Mrs. Flora Lam for their encouragement. Last but not least, special thanks to my family.

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Chapter I

Introduction

The Chinese Mainland is a huge country, especially in terms of her population. At the end of 1998, the total population of the Chinese Mainland was 1.248 billion, about one-fifth of the world's population. With such a huge proportion of the world's population, any change in her population policy will inevitably exert tremendous impact on the world, notably through the labor market and food requirements.

Such a huge and poorly educated population impedes social and economic development in the Chinese Mainland. For these reasons, the central government launched family planning policies in the 1970's and has implemented the one-child policy since 1979. Such policies seem to be successful in terms of meeting the state's population target and lowering the fertility rate[1]. However, accompanying those successes are problems, the most alarming issue being the rise in the sex ratio at birth[2]. (Table 1) It is very clear that the ratio has risen above the normal international standard of 107 (Ma et al. 1998) since the middle of the1980's and it continues to rise. Moreover, the ratio increases with the order of birth, e.g., the sex ratio at birth for the second child is larger than that for the first child. Compared to other East Asian countries with such a phenomenon, the figure in the Chinese Mainland is even higher. (Table 2) There seems to be son preference. Under the one-child policy households often choose to have a son to secure their old age and continue their ancestral line.

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[1] Concepts and definitions in demography may be found in Appendix 1.
[2] See Appendix 1 for its definition.

The higher sex ratio at birth is a concern of researchers because it will inevitably induce problems in the future. These problems include a shortage of females in the future marriage market if the norm of one marriage partner is to be up-held[3], the proliferation of such activities as infant betrothal or bride-buying, migration between regions to seek marriage partners, development of prostitution and some criminal issues such as abduction. Moreover, sex-selective abortion and infanticide itself are forms of discrimination against females. There is evidence that, after the implementation of the one-child policy, there have been more abandoned children and more than 90 per cent of them are girls. Overt sexual discrimination is a serious issue as the survival rate of abandoned children is much lower than that of other children.

The main reason behind these phenomena is often attributed to the gender bias towards sons. If no gender bias existed, there should be no such problems as the rise in the sex ratio at birth and sex-selective children abandonment. Does son preference really exist? Given the existence of gender preference, what are the factors behind it? Can this preference be influenced by factors that can be manipulated? Is there something the government can do without changing the one-child policy? Do population policies itself influence gender preference? This thesis is an attempt to answer these questions. The data from Gansu province collected in the second phase of the Chinese Mainland In-depth Fertility Survey conducted in February 1988 is used in this thesis to study the gender bias in the Chinese Mainland. Gender preference covers many areas such as discrimination

[3] According to Li, N. (1995), the sex ratio at birth in 1990 of 114 will result in 9 per cent of males without marriage partners after about 20 years.

in workplaces, political issues, and resource allocation within a family. In this thesis we focus on gender preference with respect to households' desire about the sex of their children.[4]

We estimate two econometric models and find out that: (1) Son preference does exist; (2) Economic, social and cultural factors and the population policy do influence gender preference. As households regard children not just as consumption goods, but also as investment goods, expected contributions of a son (daughter) to parents increases (reduces) son preference. The findings also suggest that there is a dilemma between population control and son preference: stringent population control intensifies son preference. The government should, in the long term, pay more attention to such policies as establishing a pension system, to ameliorate the side effects of the one-child policy. Regulations against sex discrimination should also be put into consideration. In the short term, stricter monitoring of people's fertility behaviors should be considered.

This thesis is arranged as follows. The second chapter discusses the implementation of the family planning policy and its impacts on the population and gender bias in the Chinese Mainland in general. The third chapter reviews studies on gender preference in and outside the Chinese Mainland. The economic framework will be introduced and two econometric models based on this framework are constructed in the fourth chapter. The data set used in this thesis is also introduced in this chapter. The fifth chapter discusses the estimated results of these two models. Finally, the policy implications of those results are

[4] The definition of indicators of gender preference in this thesis is discussed in chapter IV "Methodology and data".

discussed in the concluding chapter.

Table 1 Sex Ratio at Birth in the Chinese Mainland

Year	Overall	1st	2nd	3rd	4th	5th & >	1st - 4th*	Overall #	Overall $
1950	-	-	-	-	-	-	112.52	-	-
1951	-	-	-	-	-	-	109.1	-	-
1952	-	-	-	-	-	-	107.42	-	-
1953	-	-	-	-	-	-	107.57	-	-
1954	-	-	-	-	-	-	105.53	-	-
1955	-	-	-	-	-	-	106.81	-	-
1956	-	-	-	-	-	-	107.32	-	-
1957	-	-	-	-	-	-	104.89	-	-
1958	-	-	-	-	-	-	105.89	-	-
1959	-	-	-	-	-	-	102.09	-	-
1960	110.3	-	-	-	-	-	110.63	110.3	-
1961	108.8	-	-	-	-	-	108.25	108.8	-
1962	106.6	-	-	-	-	-	106.31	106.6	-
1963	107.1	-	-	-	-	-	108.28	107.1	-
1964	106.6	-	-	-	-	-	106.68	106.6	-
1965	106.2	-	-	-	-	-	106.94	106.2	-
1966	112.2	-	-	-	-	-	112.53	112.2	-
1967	106.6	-	-	-	-	-	106.46	106.6	-
1968	102.5	-	-	-	-	-	102.5	102.5	-
1969	104.5	-	-	-	-	-	106.12	104.5	-
1970	105.9	-	-	-	-	-	105.13	105.9	-
1971	105.2	-	-	-	-	-	104.63	105.2	-
1972	107	-	-	-	-	-	107.54	107	-
1973	106.3	-	-	-	-	-	105.65	106.3	-
1974	106.7	-	-	-	-	-	106.41	106.6	-
1975	106.4	-	-	-	-	-	106.52	106.4	-
1976	107.4	-	-	-	-	-	106.99	107.4	-
1977	106.7	-	-	-	-	-	105.97	106.7	-

(Continued on next page)

Table 1 - continued

Year	Overall	1st	2nd	3rd	4th	5th & >	1st - 4th*	Overall #	Overall $
1978	105.9	-	-	-	-	-	106.18	105.9	-
1979	105.8	-	-	-	-	-	105.7	105.8	-
1980	107.38	107.69	103.3	112.98	110.71	107.03	107.69	107.4	
1981	107.13	105.15	106.71	111.3	106.47	114.1	106.32	107.1	107.1
1982	107.17	106.56	105.18	109.38	112.87	109.94	107.21	107.2	107.2
1983	107.89	107.75	107.23	109.45	104.74	112.14	107.88	107.9	107.9
1984	108.46	102.48	113.27	113.04	115.35	127.28	107.37	108.5	108.5
1985	111.42	106.55	115.94	114.07	126.87	117.27	110.56	111.4	111.4
1986	112.3	105.36	116.93	123.08	125.33	123.5	111.05	112.3	112.3
1987	110.96	106.79	112.78	118.87	118.56	124.62	109.89	111	111
1988	108.1	101.5	114.5	117.1	123.1	108.7	106.49	108.1	108.1
1989	113.9	105.2	121	124.3	131.7	129.8	-	111.3	113.9
1990	114.7	-	-	-	-	-	-	-	114.7
1991	116.1	110.8	122.6	124.4(3+)	-	-	-	-	116.1
1992	114.2	106.7	125.7	126.7(3+)	-	-	-	113	114.2
1993	114.1	105.6	130.2	126.1(3+)	-	-	-	-	114.1
1994	-	-	-	-	-	-	-	-	-
1995	117.4	104.4	-	-	-	-	-	-	-

Source:

The overall figure for 1960 to 1979 is from Johansson and Nygren (1991).

1980-1987 from <<Almanac of China's Population 1991>>.

1989-1993 from Gu and Roy (1995)

1995 figure from Gao, Liu and Xia (1997)

* From <<Population and Economics>>, No. 5, 1997

From Chang and Yi (1994)

$ From Chang and Roy (1995)

Key:

"Overall" means the sex ratio of all children at birth, i.e. the number of male given birth over the number of female given birth and then time it by 100.

The i^{th} order sex ratio at birth means the sex ratio of the children in the i^{th} order of birth. For example, i =2, in the fourth column of table, the index shows that the sex ratio of all second children at birth was 124.3 in 1989.

(3+) means the 3^{rd} order of birth and above.

Table 2 Sex Ratio at Birth and Total Fertility Rate: Chinese Mainland, Taiwan and the Republic of Korea

Year	Chinese Mainland		Taiwan		South Korea	
	SRB	TFR	SRB	TFR	SRB	TFR
1980	107.4	2.24	106.4	-	103.9	-
1981	107.1	2.63	107.0	-	107	-
1982	107.2	2.86	106.9	-	106.9	2.7
1983	107.9	2.42	106.7	2.16	107.7	-
1984	108.5	2.35	107.3	-	108.7	2.1
1985	111.4	2.20	106.6	-	110.0	-
1986	112.3	2.42	107.2	1.68	111.9	-
1987	111.0	2.59	108.3	1.70	109.0	1.6
1988	108.1	2.52	108.2	1.85	113.5	1.6
1989	113.9	2.35	108.6	1.68	112.1	-
1990	114.7	2.31	110.2	1.81	116.9	1.6
1991	116.1	2.20	110	1.72	112.9	-
1992	114.2	2.00	-	-	114.0	-
1993	114.1	-	-	-	-	-

Source: Gu and Roy (1995)

Key:

SRB: Sex ratio at birth

TFR: Total fertility rate

See Appendix 1 for the definitions of SRB and TFR

Chapter II

Population Policy in PRC

To better understand the issue of gender bias, it is useful to review the population policy since the communists came to power in 1949. Statistics suggests that the population policy introduced by the Chinese government is effective in meeting population targets and reducing the total fertility rate. However, those policies also result in such unintended and perverse consequences such high sex ratio at birth and missing girls. In this chapter, we will review the population policy followed by an overview of the population growth under those policies. Finally, its perverse consequence will be discussed.

II.1/ A Historical Review

Before 1978

Since the establishment of the People's Republic of China in 1949, the health of the population improved substantially as witnessed by the falling mortality rate. As a result, the population grew at a rapid rate. The total population of PRC increased from 574.8 million in 1952 to 646.5 million in 1957 (Table 3). The birth rates during 1949 and 1957 were within the range of 31-37‰, and were thus at quite a high level. In response, the Central Committee of the Communist Party advocated birth control to bring down the birth rate to under 20‰. After a sharp reduction in the population by 10 million during the famine in the early 1960's, the birth rate and the fertility rate jumped to 37.01‰ and 6.02 respectively, and the population stood at 372.9 million in 1962. (Table 4) This prompted the Central Committee of the Communist Party to issue a document to implement birth control again in 1962. (Wang 1992) However, the Cultural

Revolution put a stop to the birth control campaign. Subsequently, the population went up to 829.9 million and 924.2 million in 1970 and 1975 respectively. In 1971, the State Council started to recognize the importance of family planning. That year, the "later-longer-fewer" (wan xi shao) campaign introduced three reproductive goals, namely later marriage, longer spacing between the first and subsequent children, and fewer children. In 1972, in a report concerning grain issues, the Central Committee of the Communist Party stressed that family planning must be rigorously promoted and advocated nationwide with the exception of those areas populated by ethnic minorities. In 1973, family planning under the direct leadership of the State Council was re-introduced. In 1974, Mao Zedong, the Chairman of the Communist Party, stated in the National Planning Committee's report concerning the 1975 national economic planning that "the population must be controlled" (Wu 1996). 1973 is the first year that family planning became part of the national economic and social development plan of PRC. The total fertility rate, birth rate, and natural growth rate fell from 5.81, 33.43‰ and 25.83‰ in 1970 to 3.57, 23.01‰ and 15.69‰ in 1975, and 2.72, 18.25‰ and 12.00‰ in 1978 respectively. (See table 3 and 4 for more details)

Although birth control and family planning were advocated as early as the 1950's, they had not been implemented consistently throughout the period. Mao Zedong once stated that "things got done with more hands" (ren duo hao ban shi). Even in 1974 when the need to have family planning became very clear, Peng Yu, China's representative to the 27th Session of the United Nations Commission said in the session that "The creative power of the people is boundless, and, so is man's ability to exploit and utilize natural resource", "revolution plus production

can solve the problem of feeding the population"[5].

After 1978

After the death of Mao Zedong, the Chinese Mainland experienced dramatic policy changes, with population policy being one of them. The "four modernization" campaign (industry, agriculture, science and technology, and defense) was put forward by the government. Rapid population growth was then regarded as an obstacle to the four modernization as it would raise unemployment and lower capital accumulation, living standards, and even hamper education (Bongaarts and Greenhalgh 1985). In addition, the large cohorts born in the middle of the 1960's would soon be entering childbearing age so that more births were expected. Under such circumstances, the one-child policy was officially announced in January 1979 (Larsen 1990). In fact, the slogan "later-longer-fewer" was modified to "one is best, at most two, never a third" at the end of 1979. (Wang 1992) To implement the one-child policy, one-child certificates were issued, offering benefits to couples who promised to have one child only. Penalties, starting from 1979, have been imposed upon couples who violate the one-child policy. In addition, a birth-quota system was initiated in 1980 to manage women's reproductive behaviors and limit the number of births each year (Li, J. L. 1995). To ground the one-child policy on a more solid legal foundation, a new marriage law was promulgated that required each couple to practize birth control.

Under the birth-quota system, the State Family Planning Commission sets a

[5] Chinese statement on population at Bucharest, 1974 (1994), *Population and Development Review* 20.

national population target with reference to long term population targets, such as limiting the population to 1.3 billion in the year 2,000 and 1.4 billion in the year 2,010[6]. The target number of births to the coming year is then passed on to the provinces. Provincial governments then assign responsibilities to local officials, through the city, country, or prefecture governments, stipulating the exact number of children permitted to be born in their areas. People who would like to give birth have to apply for a quota and the local officials allocate the birth quota among them. (Li, J. L. 1995) Local officials have to ensure that the births within the quota by such means as providing contraceptives, educating people with contraceptive knowledge and promoting the benefits of having fewer children. People giving birth without quota are subjected to penalties including fines.

During 1980-1983, there was no basic change in the family planning policy. However, there were many couples violating the policy by having two or more children. The government started to use more repressive methods to implement the one-child policy. In 1983, the government began to require sterilization of couples with two or more children, and abortion of unauthorized pregnancies (Larsen 1990). Such repressive methods did heighten tensions between couples and local family planning cadres. In response to the resistance, the Party Central Committee reviewed its policy in 1984 and issued Central Document 7 (Hardee-Cleaveland and Banister 1988). The overall objective of the Document 7 was to set up a realistic, fair and reasonable family planning policy that was easy for cadres to implement under the goal of limiting the total population at 1.2 billion in the year 2,000.

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[6] Statement of Li Peng in the Ninth-Five Year Plan for the national socio-economic development of the People's Republic of China and the programme for the long-term objectives by 2010. See *Almanac of China's Population 1997* : 2.

The Document 7 highlights three principles. According to Greenhalgh (1986), they were:

> *First, family planning must serve the overall situation. In other words, birth planning must serve the country's larger goals of developing the economy, raising living standards, and achieving the "four modernization" in agriculture, industry, defense, science and technology. Second, family planning cadres must seek truth from facts, changing policies and work methods only after careful investigation of local conditions. Criticizing the previous tendency to impose uniform measures on all couples and localities, the document urged cadres to be more flexible, to deal with cases on an individual basis, and to adapt methods to changing circumstances. Third, family planning must follow the mass line. With the aim of increasing voluntary participation in the program and improving the Party's relations with the people, the document instructed family planning workers to establish close rapport with the people, learn their needs, and, through rendering practical assistance, help them solve the concrete problems that underline their desires for more children.*

As the strong resistance to the one-child policy in some areas could have resulted in political instability, the government adopted a less restrictive policy. It adopted a strategy called "open a small hole to close up a large one" allowing certain types of couples to have a second child while the rest were only allowed to have one child. According to Greenhalgh (1986) there are two basic principles guiding the second-birth regulations, namely preserving the patrilineal family and

reducing gross inequalities which put burdens on underprivileged areas and groups. For example, in the former case, both spouses that are the only child of their own parents may get a quota for a second child in certain areas; in the latter case, both spouses belonging to ethnic minority groups may get a quota too. These principles seem to reflect that there were two kinds of individual most strongly opposing the one-child restriction. They were those who wished to preserve their patrilineal line and those who, for regional, occupational, or ethnic reasons, were in poor economic circumstances relative to the rest of the population.

Greenhalgh (1986) also points out that there were three large policy shifts: (1) administratively, a shift from reliance on mobilization-type methods to more regularized and scientific management techniques; (2) strategically, a shift from focusing on changing ideas to an emphasis on altering socioeconomic conditions; (3) politically, a shift from an idealistic social engineering approach that assumes society is infinitely malleable, to a more realistic political strategy that accommodates socio-cultural realities. The Document 7 has great significance in the population control in PRC, as it lays out the fundamental philosophy upon which population policy has been based until now. Although some later documents have been issued, all were supplementary to the Document 7.[7]

Family planning was not stringently implemented in many areas of the Chinese Mainland between mid-1984 to mid-1986. The rising birth rate was not curbed. In response to rumors that the policy had changed to allow couples to have more than two children, the Party's Central Committee issued Document 13 to

[7] See Greenhalgh, 1986.

supplement, clarify and reconfirm the Document 7 in May 1986. Since the middle of 1980's, the family planning policy was implemented together with more economic incentives. For example, in some areas, individuals who were not on the household register, normally out-of-plan children, were not eligible for allocation of cropland, which were adjusted every three years, and receipt of housing land at the time of marriage. (Greenhalgh et al. 1994)

In the second half of the 1980's and the first half of the 1990's, the Chinese Mainland faced a birth peak. It was the direct consequence of the high birth rates that followed the Great Leap Forward of 1958-1961 and lasted from 1962 through the early 1970's. As these children became adults, the number of couples increased. The difficulty in controlling the growth of population can be seen in table 3. The birth rate and natural growth rate in 1980 were 18.21‰ and 11.87‰ and jumped to 23.33‰ and 16.61‰ in 1987. The government recognized the situation and began to reassess its family planning program to strengthen implementation. With the existence of the patrilineal cultural norm, to gain the support of peasants for its population policy, in 1989 the government allowed couples in most rural areas whose first child was a daughter to have a second child (Li, J. L. 1995). As stated above, the population policy towards people in underprivileged areas and groups including poor areas was lenient. In general, notwithstanding the relaxation of the one-child policy for families with their first child being female in rural areas, enforcement has been more vigorous and persistent since the late 1980's. However, having more children imposed a bigger burden for economic development in poor areas. In 1989, in the report by the State Family Planning Commission and the Leading Group for the Development of Poor Areas, the government decided to integrate birth control with support for

the rural poor.

By the end of 1989, the total population amounted to 1,127 million, and the birth and natural growth rates were 21.58‰ and 15.04‰ respectively. Under such reality, in 1990, the government adjusted its population target in its ten-year national economy and social development plan and the 8th Five-year Planning, changing the target population in the year 2,000 from under 1.2 billion to under 1.3 billion. Also, it targeted the natural growth rate to be under 12.5‰ within the following ten years (Li 1991).

1991 was the first time that the annual national population target was reached (Li 1992). In this year, the government issued the document entitled "The Joint Resolution of the Central Committee of the Communist Party of PRC and the State Council for strengthening the family planning work and strictly controlling population growth" to strengthen the implementation of birth control by putting the responsibility of birth control on the shoulders of the highest ranking officials at each level. It linked the promotion of cadres directly to the results of population policy in their respective areas. This document stressed that the current population policies and strategy must be continuously implemented, and put more efforts on social welfare and social security in rural areas such as developing old age insurance.

As the birth peak was over in early 1990's, the birth rate and natural growth rate came down very fast. These two figures went down from 21.06‰ and 14.39‰ in 1990 to 17.12‰ and 10.55‰ in 1995. The total population only grew 5.9 per cent in this period. The population growth rates in 1995, 1996 and 1997 were just

1.06 per cent, 1.05 per cent and 1.01 per cent respectively, which lower than 1.35 per cent, the average population growth rate in the world in the first half of 1990's (Liu 1997). Some analysts pointed out that the lowering of the birth rate was largely due to economic development as human capital becomes important when an economy developed into a certain level. Households would like to invest more on a child in order to develop this child's human capital rather than having more children. There were discussions about population targets could be attained through economic development, so that the population policy could be relaxed. In response to that kind of view, Jiang Zemin, the Chairman of the Party, expressed that it was wrong that the population target could be reached by market forces under market economy[8]. That "announcement" ensured continuation of population control policy.

In 1996, the Fourth Session of the Eighth National People's Congress passed the "Ninth-five Year Plan for the National Socio-economic Development, the Program for the Long-term objectives by 2,010". In this document, the government determined to limit the average annual natural growth rate of population to under 1.08 per cent in the Ninth-five Year (Zhang and Li 1997). Due to the success in limiting the growth of the population, the population policy continued without big change.

In 1999, the central government announced that the family policy would be continuously implemented in order to maintain a low population growth. To make family policy more effective and with less resistance, the family planning

[8] In Jiang Zemin's speech at the symposium convened by the Central committee of the Communist Party and the State Council for Family Planning Work. See *Almanac of China's Population 1995* : 1.

program was to be implemented more closely with the effort of developing local economies, supporting the poor, providing universal education, protecting the environment and raising women's status. The population target for 2010 is under 1.4 billion. (Hong Kong Economic Journal, October 13, 1999)

In short, the family policy was not consistently implemented until the 1970's due to political consideration. As the large and rapidly growing population became an obstacle to the "four modernization" of the Chinese Mainland, the government introduced the one-child policy in 1979. However, as the one-child policy conflicted with the traditional son preference and big families, especially in rural areas, there were conflicts between households and local family cadres. In order to release the tension and successfully implement the population policy, the government relaxed the one-child policy, allowing households who have a daughter as their first child to have a second child in rural areas. Since the late 1980's, the government has increasingly recognized the contribution of economic factors in controlling population growth. She decided to implement family policy with more economic incentives, though there has not been any big policy shift since the promulgation of the Document 7.

II.2. Overview of the Fertility Rate and Population Growth under the Population Policy in the Chinese Mainland

The Chinese Mainland has been carrying out its population policy to lower population growth for nearly thirty years since the 1970's. It is time to look at its effects. From table 4 and diagram 1, the total fertility rate in the Chinese Mainland remained high, about 6, from 1949 to 1958. Then it fell to 3.29 in 1961 due to the Great Leap Forward and the famine that followed. Then it returned to around 6 until the early 1970's.

Alarmed by the rise in fertility rate, family planning policy was given more attention in the upper echelon of the government. Since then, the rate has been on the decline, interrupted only by short episodes of fertility spurts. The relaxation of the one-child policy after the promulgation of the Central Document 7 in 1984 may be the reason behind the increase in fertility around the second half of the 1980's, though no solid evidence is available.

The government's policy shifts emphasizing socioeconomic rather than ideological measures may be one of the factors attributing to the continuous decline in fertility after 1988. These shifts were very important as it took into account socioeconomic factors that influenced households' decisions on family size into the formulation of the population policy. This did not only resolve the political conflict but also motivate households to have fewer children. In 1992 the rate fell below the replacement level of 2 and the downward trend has continued unabated. This may be due to the shift in the means for implementing family planning and the strengthening of family planning work since the earlier 1990's. In addition, rapid economic development and higher living standards

raise the cost of bearing children.

On the whole, in so far as the decline in the fertility rate and population growth are concerned, the population policy seems to be effective, though the decline is not sharp enough to meet the government's population target set in the 1980's. The Central Document 7 issued in 1984 aimed at limiting the total population at 1.2 billion in the year 2,000, but the total population already exceeded 1.2 billion by 1995. In 1990, the government adjusted its population target in the year 2,000 from under 1.2 billion to under 1.3 billion. The government aimed at controlling the natural growth rate to be under 12.5‰ in next ten years (Li 1991). With these redefined targets, the family planning policy was quite successful in the 1990's in respect of limiting the population growth rate. The target of limiting the average annual natural growth rate to less than 1.08 per cent in the Ninth-five Year Plan seems to be attainable. According to the State Family Planning Commission, the population was reduced by 338 million in the past 30 years due to the family planning policy. (Hong Kong Economic Journal, September 28, 1999)

So far, we have studied the national picture. Next, we look into figures in rural and urban areas. From table 5, the birth rates and natural population growth rates of both cities and counties fell over time. Both the birth rates and natural population growth rates of counties were higher than those of cities. This may due to the differences in economic development, economic activities and implementation of the population policy. First, the higher incomes of households in cities imply higher costs in raising children and higher return of investment in the human capital of a child. Second, as family planning authorities in cities had

more resources than that in counties, they may be able to offer more attractive incentives and better services, including contraceptive means to encourage households to follow the one-child policy.[9] Third, family planning units in cities also had better controlling systems, such as they could implement the policy through the help of the compensation and benefits offered to workers in state owned enterprises.

As stated above, the decline in the birth rate and natural population growth rate may be attributed to factors other than population policy, such as economic development. Table 6 shows the figures of the birth rate, natural population growth rate and GDP per capita for all provinces in 1997. We find out that the correlation coefficient of the GDP per capita and birth rate is -0.73524, and that of the GDP per capita and natural population growth rate is -0.73373. They are highly negatively correlated.

In short, the population policy was effective in terms of reaching population targets and lowering the fertility rate. Notwithstanding the success in controlling population growth, the population policy seems to have generated some perverse side effects which will be discussed in the next section.

[9] Banister (1987) finds out the economic rewards from signing the one-child pledge in the countryside were so much less than those in cities.

II.3/ Impacts of the Population Policy on Gender Issue

The population policy, especially the one-child policy, exerts pressure on households as they have to satisfy their son preference within just one child. In response to the policy, some households try various means to have sons. They may resort to sex-selective abortions and girl abandonment. As a result, the population policy not only has impact on population growth, but also has perversely effects on sex ratio at birth, sex ratio of infant and children mortality, girl abandonment and intra-household resource allocation.

II.3.1/ Sex Ratio at Birth

We first look at the sex ratio (defined as percentage of males over females) of the population shown in table 7. In 1955, the sex ratio was as high as 107.3. This ratio remained high in the 1950's and then fell to between 104 – 106 until 1975. Between 1975 and 1980, there was no discernible trend. However, after 1981 the ratio exhibits a rising trend until 1985. Then the ratio stayed at around 106 to 107 for about a decade. In 1997, the ratio was 106.3. (Diagram 2)

The increase in the sex ratio of the total population must be the result of the higher population growth of males over females. This in turn might be the result of a higher sex ratio at birth. From table 1, we already know that the sex ratio at birth has been increasing over time since the early 1980's, and since the mid-1980's the ratio has been higher than 107, which is the normal sex ratio at birth for many countries. (Ma. et al. 1998) It is widely believed that the one-child policy increased the sex ratio at birth because of son preference due to the patritlineal reason and higher socio-economic status of male.

At the regional level, the ratio for counties was higher than that in towns and cities meanwhile the ratio in towns was larger than that in cities. (Table 8) This may be due to a stronger son preference and less stringent control of family planning in rural areas. Table 9 shows the sex ratios at birth by provinces. With the exception of Shanghai, Guizhou and Xinjiang, the provincial ratios exceed 107. It seems that most of the provinces with low sex ratios at birth are inland provinces. The ratios not only are at high levels, but also increase over time. Table 10 lists the sex ratio at birth of the 9 most populated provinces over time. The ratios increase over time. In other words, if we treat the ratio as one of the indicators for gender preference, the situation of gender inequity is getting worse over time. Among the 9 provinces, Hubei's ratio increased from 106.9 to 134.6.

Sex-selective abortion is likely to be one of the main reasons explaining the high sex ratios at birth. Table 11 reports the sex ratios of aborted fetuses in the southern Zhejiang province in 1993. The ratio is as low as 86.7. If we take 107 as a nominal sex ratio at birth, it is difficult to believe that the relative higher rate of aborted female fetuses is purely accidental. The picture will be clearer if we look at the composition of the sex of surviving children. For families without children, the sex ratio of aborted fetuses is 107.9, very close to 107. With only one male child, the sex ratio of aborted fetuses is 108.0. With only one female child, the sex ratio drastically decreases to 51.0. It seems that there is no gender preference in abortion for families with no child or with a son. However, for families with only daughters, there is a sexual bias with respect to abortion. It is clear that there were sex-selective abortions.

According to Greenhalgh and Li (1995), since mid-1993, when the rise in the sex

ratio was first officially acknowledged, virtually the only policy adopted to counteract the trend was the ban on the use of ultrasound B equipment for prenatal sex determination. This indicates the fact that the government indeed recognized that sex-selective abortions have become a problem.

II.3.2/ Infant and Child Mortality

Table 12 shows the ratio of infant mortality rate between the two sexes over time. The "normal" sex ratio among infant deaths is 130 (Johansson and Nygren 1991). As shown in table 12, the ratios are below 130 over years. There was a big drop in the ratio in 1980 and then it remained at a relatively low level compared to the period before 1980, except in 1985. According to the 1990 population census data (Gu 1992), the male and female infant mortality rates in 1989 were 3.55 per cent and 4.04 per cent respectively, implying that the sex ratio of infant mortality rate was 87.8. Gu (1992) observes that the male infant mortality rate fell by 0.33 per cent and that of female rose by 0.35 per cent compared with the figure in the 1982 population census. Without the assumption of gender preference and the restrictive one-child policy, it is very hard to explain why the male infant mortality rate decreased while that of female increased.

At the province level, the ratios for all provinces in 1981 and 1989 are below 130 except for Tibet in 1989. (Table 13) Even if we take 100 as the standard, the number of provinces with the ratio below 100 increases from 4 to 19 between 1981 and 1989. If we look at the column of "change overtime" for child mortality in table 14, the picture is clearer: the ratios for all provinces decrease over time. This means female infant mortality rate improved at a slower rapid pace than that of male infants.

Let us consider the child mortality rate. Table 13 indicates that the number of provinces with a ratio of child mortality rate between the two sexes lower than 100 rose from 23 in 1981 to 24 in 1989. The ratio in Jiangxi was as low as 66. The ratios for all provinces decreased from 1981 to 1989 except for Liaoning, Jilin, Jiangsu, Zhejiang, Qinghai and Xinjiang. Li and Feldman (1996) find out that the provinces with higher female infant and child mortality rate were mainly southeast or coastal provinces, such as Jiangsu, Zhejiang, Shandong, Anhui and Guongdong, or regions with higher socioeconomic development, such as Beijing, Shanhai and Liaoning. Provinces with lower socioeconomic development or a higher proportion of ethnic minorities had relatively normal sex differences in infant and child mortality.

Table 14 reports the infant mortality rate across different countries. The son preference in the Chinese Mainland is obvious. Biologically, the male infant mortality is higher than that of female. However, in the Chinese Mainland, the female infant mortality was much higher than the male's by 10.1‰. In table 12, only the Chinese Mainland and Egypt had the female infant mortality higher than the male's.

II.3.3/ Treatments Towards Male and Female Children

There are arguments about whether there is sex discrimination in the treatment towards children. Wu and Wang (1991) apply the data from a survey of 8 villages and towns in Shandong in 1985 to the Cox model to find the relationship between the sex of children and the medical treatments they received before death. There is no evidence of sex discrimination in receiving medical treatment.

However, this contradicts the figures of infant and child mortality rate of the two sexes. As stated above, the female infant and child mortality rates have been abnormally high relative to that of male. If there was no sex discrimination in the treatment towards children, how can we explain the figures?

As pointed out by Li and Feldman (1996), although there may not be sex discrimination in medical treatment as suggested by Wu and Wang (1991), there is more and more evidence pointing to the existence of sex discrimination along other dimensions. (See the presentations about breast-feeding in the International Seminar on China's 1990 census) According to a survey on 10 provinces in 1992 (Tian 1993), households invest more in both monetary and non-monetary terms in male children than in female children.

Under the one-child policy or two-child policy, whenever the first child is a girl, households may abandon their female child if they would like to preserve the chance for another pregnancy to have a son[10]. In fact, according to Johnson (1996) and Johnson et al. (1998), more than 90 per cent, of the abandoned children are girls. According to a survey of Johnson et al. (1998), when about 60 per cent of the abandoned male children are handicapped, the corresponding figure for females is eight per cent. Details are summarized in table 15. Most of the abandoned girls only have sisters in their families. 88 per cent of the families abandoning children in the survey are from rural areas and with agricultural household registration. Households in rural areas are allowed to have a second child if the first child is a female. So the high percentage of abandoned girls

[10] Abandonment could cause a rise of the sex ratio at birth as most of the abandoned are female children and their births may not be recorded by the authorities. If the abandoned are taken to welfare centers, they may be counted into census statistics. But it is not a certainty, as some of the

having only one sister and no brothers (35 per cent) seems to reflect the households' desire of having sons.

In short, the population policy, especially the one-child policy, has caused problems like the rising sex ratio at birth, a relatively high female infant and child mortality, and a high level of girl abandonment. The increase in sex ratio at birth will also cause a shortage of women in the marriage market in the foreseeable future. This may result in large-scale bride-buying and migration as men seek marriage partners. The problem of prostitution and criminal issues such as rape and abduction may become more serious too.

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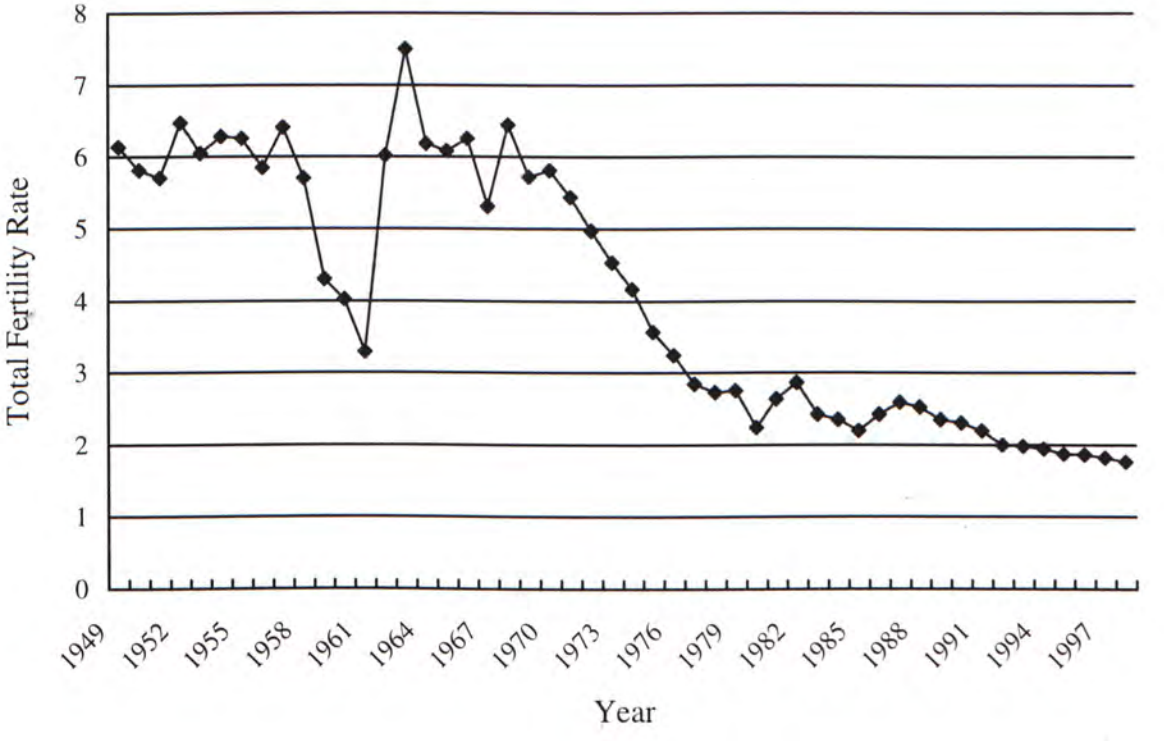
abandoned children in welfare centers may not get residential registrations. (See Johnson 1996)

II.4 Conclusion

In this chapter, we reviewed the history of the family planning policy in the Chinese Mainland since 1949. Although the population control policy was promulgated since the 1950's, it was not consistently implemented before 1970's due to political reasons. In 1979, as the huge and rapidly growing population became a burden to the "four modernization" program, the government implemented the one-child policy in order to reduce fertility and slow down the population growth. Since then, the government has exerted a lot of effort in that direction. With the emphasis on socioeconomic factors since the mid-1980's, the population policies have been successful in terms of meeting population targets and reducing the total fertility rate.

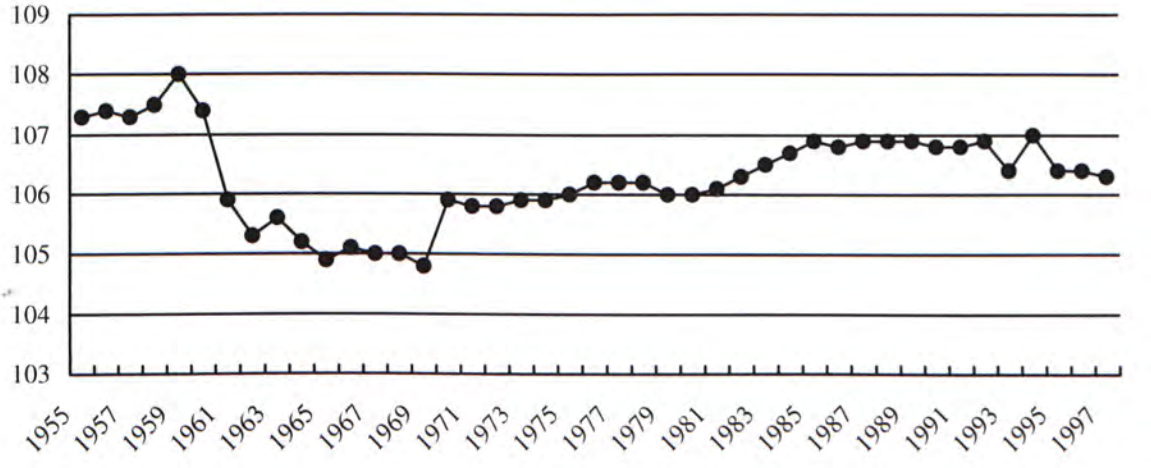
However, the population policy engenders problems related to gender preference, e.g. rising sex ratio at birth, higher mortality rate for female infant and an increase in the number of girl abandonment. The high sex ratio at birth and mortality rate for female infant will result in imbalance of the two sexes and cause problems in the future. Higher girl abandonment itself is a serious form of sex discrimination as abandonment could cause causality.

Diagram 1 Total Fertility Rate in the Chinese Mainland



Source: 1949-1990: Wang (1999); 1991-1992: Gu and Roy (1995); 1993-1998: calculated by Qiao (1999).

Diagram 2 **Sex Ratio in the Chinese Mainland**



Source: China Population Statistical Yearbook 1998

Table 3 Total Population, Birth Rate, Death Rate and Natural Growth Rate of the Chinese Mainland

Year	Total population (Year end) (10,000 persons)	Birth rate (‰)	Death rate (‰)	Natural growth rate (‰)
1952	57482	37.00	17.00	20.00
1957	64653	34.03	10.80	23.23
1962	67295	37.01	10.02	26.99
1965	72538	37.88	9.50	28.38
1970	82992	33.43	7.60	25.83
1975	92420	23.01	7.32	15.69
1978	96259	18.25	6.25	12.00
1980	98705	18.21	6.34	11.87
1985	105851	21.04	6.78	14.26
1986	107507	22.43	6.86	15.57
1987	109300	23.33	6.72	16.61
1988	111026	22.37	6.64	15.73
1989	112704	21.58	6.54	15.04
1990	114333	21.06	6.67	14.39
1991	115823	19.68	6.70	12.98
1992	117171	18.24	6.64	11.60
1993	118517	18.09	6.64	11.45
1994	119850	17.70	4.49	11.21
1995	121121	17.12	6.57	10.55
1996	122389	16.98	6.56	10.42
1997	123626	16.57	6.51	10.06
1998	124810	16.03	6.50	9.53

Source: China Statistical Yearbook 1999

See Appendix 1 for the definitions of birth rate, death rate and natural growth rate.

Table 4 Total Fertility Rate in the Chinese Mainland

Year	Total fertility rate	Year	Total fertility rate
1949	6.14	1974	4.17
1950	5.81	1975	3.57
1951	5.70	1976	3.24
1952	6.47	1977	2.84
1953	6.05	1978	2.72
1954	6.28	1979	2.75
1955	6.26	1980	2.24
1956	5.85	1981	2.63
1957	6.41	1982	2.86
1958	5.70	1983	2.42
1959	4.30	1984	2.35
1960	4.02	1985	2.20
1961	3.29	1986	2.42
1962	6.02	1987	2.59
1963	7.50	1988	2.52
1964	6.18	1989	2.35
1965	6.08	1990	2.31
1966	6.26	1991	2.20
1967	5.31	1992	2.00
1968	6.45	1993	1.98
1969	5.72	1994	1.94
1970	5.81	1995	1.87
1971	5.44	1996	1.86
1972	4.98	1997	1.82
1973	4.54	1998	1.76

Source: 1949-1990: Wang (1999); 1991-1992: Gu and Roy (1995); 1993-1998: calculated by Qiao (1999)

Table 5 Birth Rate, Death Rate and Natural Growth Rate of Cities and Counties of PRC

Year	Cities			Counties		
	Birth rate (‰)	Death rate (c)	Natural growth rate (‰)	Birth rate (‰)	Death rate (c)	Natural growth rate (‰)
1957	44.48	8.47	36.01	32.81	11.07	21.74
1962	35.46	8.28	27.18	37.27	10.32	26.95
1965	26.59	5.69	20.90	39.53	10.06	29.47
1970	-	-	-	-	-	-
1975	14.71	5.39	9.32	24.17	7.59	16.58
1978	13.56	5.12	8.44	18.91	6.42	12.49
1980	14.17	5.48	8.69	18.82	6.47	12.35
1985	-	-	-	-	-	-
1986	-	-	-	-	-	-
1987	-	-	-	-	-	-
1988	-	-	-	-	-	-
1989	16.73	5.78	10.95	23.27	6.81	16.46
1990	16.14	5.71	10.43	22.80	7.01	15.79
1991	15.49	5.50	9.99	21.17	7.13	14.04
1992	15.47	5.77	9.70	19.09	6.91	12.18
1993	15.37	5.99	9.38	19.06	6.89	12.17
1994	15.13	5.53	9.60	18.84	6.80	12.04
1995	14.76	5.53	9.23	18.08	6.99	11.09
1996	14.47	5.65	8.82	18.02	6.94	11.08
1997	14.52	5.58	8.94	17.43	6.90	10.53
1998	13.67	5.31	8.36	17.05	7.01	10.04

Source: China Statistical Yearbook 1999

Table 6 Total Population and Birth Rate, Natural Growth Rate and GDP by Region (1997)

Region	Total population (Year end) (10,000 persons)	Birth rate (‰)	Natural growth rate (‰)	GDP per capita (Renminbi)
Beijing	1240	7.91	1.89	14598
Tianjin	953	9.98	3.03	13016
Hebei	6525	13.11	6.29	6059
Shanxi	3141	16.18	10.12	4712
Inner Mongolia	2326	15.21	8.25	4706
Liaoning	4138	11.78	5.40	8434
Jilin	2628	12.22	6.80	5506
Heilongjiang	3751	12.02	6.85	7221
Shanghai	1457	5.50	-1.30	23063
Jiangsu	7148	11.43	4.59	9346
Zhejiang	4435	11.41	4.93	10458
Anhui	6127	15.80	9.30	4358
Fujian	3282	12.41	6.32	9142
Jiangxi	4150	17.43	10.87	4133
Shandong	8785	11.28	4.63	7570
Henan	9243	13.97	7.67	4413
Hubei	5873	14.81	8.12	5875
Hunan	6465	12.59	5.60	4630
Guongdong	7051	16.90	11.50	10375
Guangxi	4633	15.93	9.53	4350
Hainan	743	19.18	13.56	5516
Chongqing	3042	13.60	6.24	4438
Sichuan	8430	15.75	8.75	3938

(Continued on next page)

Table 6 - continued

Region	Total population (Year end) (10,000 persons)	Birth rate (‰)	Natural growth rate (‰)	GDP per capita (Renminbi)
Guizhou	3606	22.15	14.48	2199
Yunnan	4094	20.82	12.91	4016
Tibet	248	23.90	16.00	3104
Shannxi	3570	13.91	7.62	3714
Gansu	2494	17.22	11.02	3133
Qinghai	496	21.80	14.85	4074
Ningxia	530	18.90	13.47	3980
Xinjiang	1718	19.66	13.11	6113

Source: China Statistical Yearbook 1998

Table 7 Sex Ratio of the Chinese Mainland

Year	Sex Ratio (Female =100)	Year	Sex Ratio (Female =100)
1955	107.3	1977	106.2
1956	107.4	1978	106.2
1957	107.3	1979	106.0
1958	107.5	1980	106.0
1959	108.0	1981	106.1
1960	107.4	1982	106.3
1961	105.9	1983	106.5
1962	105.3	1984	106.7
1963	105.6	1985	106.9
1964	105.2	1986	106.8
1965	104.9	1987	106.9
1966	105.1	1988	106.9
1967	105.0	1989	106.9
1968	105.0	1990	106.8
1969	104.8	1991	106.8
1970	105.9	1992	106.9
1971	105.8	1993	106.4
1972	105.8	1994	107.0
1973	105.9	1995	106.4
1974	105.9	1996	106.4
1975	106.0	1997	106.3
1976	106.2		

Source: China Population Statistical Yearbook 1998 (Figures are taken from the annual report of the Ministry of Public Security)

Note: There seems to be some inconsistencies among different data sets. As shown in table one, the sex ratio at birth has been larger than 106 since 1972 that should have made the overall sex ratio increase overtime. However, the overall sex ratio at birth in 1997, 106.3, is very close to that in 1976, 106.2. This needs further study.

Table 8 Sex Ratio at Birth in Cities, Towns and Counties (1994.10.1 – 1995.9.30)

Region	Total births	Male	Female	Sex Ratio (Female =100)
National	177437	95144	82293	115.62
City	29736	15689	14046	111.70
Town	13465	7226	6239	115.82
County	134235	72227	62008	116.48

Source: China Population Statistical Yearbook 1997 (Figures of the 1% Population Sample Survey in 1995)

Table 9 Sex Ratio at Birth by Region (1994.10.1 – 1995.9.30)

Region	Sex Ratio (Female =100)	Region	Sex Ratio (Female =100)
National	115.62	Henan	126.68
Beijing	122.44	Hubei	130.30
Tianjin	110.47	Hunan	116.40
Hebei	115.24	Guongdong	123.08
Shanxi	112.01	Guangxi	119.13
Inner Mongolia	109.98	Hainan	124.47
Liaoning	111.43	Sichuan	110.05
Jilin	109.59	Guizhou	99.06
Heilongjiang	109.96	Yunnan	108.49
Shanghai	104.84	Tibet	100.69
Jiangsu	123.42	Shannxi	123.09
Zhejiang	115.19	Gansu	108.59
Anhui	116.38	Qinghai	107.14
Fujian	122.29	Ningxia	107.42
Jiangxi	115.35	Xinjiang	102.01
Shandong	118.80		

Source: China Population Statistical Yearbook 1997 (Figures of the 1% Population Sample Survey in 1995)

Table 10 Sex Ratio at Birth of the 9 Most Populated Provinces in 1982, 1987, 1990 and 1995

Provinces	1982		1987		1990		1995	
	Sex ratio at birth	Rank	Sex ratio at birth	Rank	Sex ratio at birth	Rank	Sex ratio at birth	Rank
Chinese Mainland	108.5	-	110.5	-	114.4	-	117.5	-
Hubei	106.9	9	10.5	9	109.5	9	134.6	1
Henan	110.3	3	117.4	1	116.6	1	125.2	2
Jiangsu	107.8	7	113.6	4	114.5	3	125.1	3
Anhui	112.4	1	114.8	2	110.4	8	118.8	4
Shandong	109.8	4	114.5	3	115.9	2	118.2	5
Hunan	107.6	8	108.3	8	110.4	7	116.6	6
Guangdong	110.4	2	108.4	7	111.7	5	115.8	7
Hubei	108.1	5	113.1	5	112.3	4	115.6	8
Sichuan	107.9	6	110.7	6	111.5	6	111.4	9

Source: Yan, Mao and Lu (1999)

Table 11 Sex Ratio of Aborted Fetuses by Number and Sex of Surviving Children: Southern Zhejiang Province, 1993

Surviving children		Total aborted	Male fetuses aborted	Female fetuses aborted	Sex ratio of aborted fetuses
Male	Female				
0	0	4518	2345	2173	107.9
1	0	2559	1329	1230	108.0
0	1	3124	1055	2069	51.0
2+	0	81	40	41	97.6
0	2	105	38	67	56.7
0	3+	15	4	11	36.4
1+	1+	380	196	184	106.5
Total		10782	5007	5775	86.7

Source: Gu and Li (1994), Sex ratio at birth and son preference in China, Paper presented at the UNDPA/KIHASA International Symposium on Issues Related to Sex Preference for Children in the Rapidly Changing Demographic Dynamics in Asia, 21-24 November, Seoul, Republic of Korea. (Quoted from Gu and Roy 1995)

Table 12 Ratio of Infant Mortality Rate between the Two Sexes from 1950-1989

Year	Ratio of infant mortality rate between the two sexes
1950-1954	112
1955-1959	110
1960-1964	109
1965-1969	111
1970-1974	112
1975	110
1976	107
1977	111
1978	115
1979	112
1980	104
1981	105
1982	104
1983	106
1984	107
1985	110
1986	96
1987	105
1988	-
1989	87

Source: Li and Feldman (1996)

Table 13 Ratio of the Infant and Child Mortality Rate between the Two Sexes in Different Regions of the Chinese Mainland in 1981 and 1989

Region	Infant mortality ratio		Change over time	Child mortality ratio		Change over time
	1981	1989		1981	1989	
City	111	95	-0.17	94	84	-0.10
Town	107	85	-0.22	96	95	-0.01
Xian	105	87	-0.18	.90	79	-0.11
Beijing	109	105	-0.04	111	105	-0.07
Tianjin	109	104	-0.05	103	83	-0.20
Hebei	116	98	-0.18	98	93	-0.05
Shanxi	104	88	-0.16	100	80	-0.20
Inner Mongolia	115	94	-0.20	96	85	-0.11
Liaoning	116	106	-0.10	94	105	0.11
Jilin	114	105	-0.10	90	108	0.17
Heilongjiang	127	115	-0.11	94	92	-0.02
Shanghai	123	107	-0.16	141	97	-0.45
Jiangsu	93	92	-0.02	99	100	0.00
Zhejiang	88	84	-0.04	93	96	0.03
Anhui	87	86	-0.01	95	88	-0.07
Fujian	106	90	-0.16	87	79	-0.09
Jiangxi	101	79	-0.22	74	66	-0.08
Shandong	100	77	-0.23	94	75	-0.19
Henan	97	82	-0.15	96	89	-0.07
Hubei	110	94	-0.15	95	70	-0.25
Hunan	109	93	-0.16	87	77	-0.10
Guongdong	104	85	-0.18	97	75	-0.22
Guangxi	100	84	-0.16	94	90	-0.04
Hainan	-	85	-	-	96	-
Sichuan	102	86	-0.16	86	70	-0.16

(Continued on next page)

Table 13 - continued

Region	Infant mortality ratio		Change over time	Child mortality ratio		Change over time
	1981	1989		1981	1989	
Guizhou	110	92	-0.18	82	72	-0.11
Yunnan	117	100	-0.17	92	79	-0.13
Tibet	-	132	-	-	100	-
Shannxi	103	86	-0.17	94	80	-0.15
Gansu	112	94	-0.18	84	70	-0.14
Qinghai	120	118	-0.01	87	93	0.05
Ningxia	123	102	-0.21	100	91	-0.09
Xinjiang	117	112	-0.05	98	113	0.14

Source: Li and Feldman (1996)

Table 14 Infant Mortality Rate (in a year after birth) by Countries in 1996 with GNP Per Capita Figures

Country	GNP per capita in 1997, Atlas methodology (US dollars)	GNP per capita by Purchasing Power Parity in 1997 (International dollars)	Mortality rate	Mortality rate of male	Mortality rate of female
		High income economics			
Japan	37,850	23,400	3.8	4.1	3.4
United States	28,740	28,740	7.6	8.3	6.8
Germany	28,260	21,300	5.0	5.6	4.4
Netherlands	25,820	21,340	5.7	6.3	5.1
Australia	20,540	20,170	5.8	6.5	5.0
		Upper middle income economics			
Chile	5,020	12,080	11.7	12.7	10.6
Malaysia	4,680	10,920	9.1	10.0	8.1
Hungary	4,430	7,000	10.9	11.5	10.2
Mexico	3,680	8,120	16.9	19.0	14.7
Poland	3,590	6,380	12.2	13.4	10.9
Venezuela	3,450	8,530	21.4	23.8	18.8
		Lower middle income economies			
Belarus	2,150	4,840	12.6	14.3	10.8
Ecuador	1,590	4,820	29.4	31.5	2.71
Romania	1,420	4,290	22.3	24.3	20.2
Kazakhstan*	1,340	3,290	27.7	31.8	23.3
Morocco	1,250	3,130	17.8	20.4	15.5
Egypt#	1,180	2,940	36.3	35.3	37.5
China^	**860**	**3,570**	**37.4**	**32.9**	**43.0**
		Low income economics			
Kyrgyz Republic*	440	2,040	27.7	31.8	23.3

Source:

GNP figures are from the World Bank database on the Internet

Mortality rates, except that of China, are from the Demographic Yearbook 1997

Mortality rates of China are from the China Population Statistics Yearbook 1998

Notes:

* 1995 figures

1992 figures

^ 1997 figures; all others are 1996 figures

Table 15 Birth Order and Sibling Composition of Abandoned Female Children

	Only child (first-born daughter, no brothers)	Brothers only	Brother(s) and daughter(s)	Sisters only				Total
				1	2	3	4	
Number of abandoned	11	4	21	69	62	26	3	196
Percent	5.5	2	11	35	32	13	1.5	100

Source: Johnson et al. (1998)

Chapter III

Literature Review

As a prelude to our econometric analysis of those factors affecting gender bias, it is useful to review the literature of gender bias in the Chinese Mainland. Through such a review, we hope to identify a set of factors influencing gender bias. There are a lot of studies on a wide range of issues pertaining to gender preference. This review focuses on those related to the sex of children. This chapter is divided into three parts. International experience in the study of gender preference is discussed first. Then, the focus is on studies of gender preference in the Chinese Mainland followed by a conclusion.

III.1/ International Experience

Many studies suggest that the phenomenon of gender bias is not only unique to the Chinese Mainland. Indeed, this phenomenon is not confined to Asia, but can be found in other places such as North Africa. Researchers find out that gender preference is influenced by various factors including economic, social, cultural and political elements. These studies provide much valuable information on gender preference.

Initially, gender bias was the subject of demography, sociology and feminist studies. Economists started to study the issue since Gary Becker extended the field of economic analysis beyond its traditional boundary, to include such human behaviors as marriage, birth, divorce, etc. Gary Becker established the micro-foundation of the economics of family. He introduces the cost and benefit analysis to the demand for children that can easily be extended to the study of

gender issues. Adopting this micro-foundation, economists and researchers of other disciplines have done a lot of work explaining the reasons behind the phenomena of gender preference.

As quoted by Li (1998), Winston, in his 1932 study, asked 55 male undergraduates about their sex preference of children and found out the desired male-female ratio was 165. This was the earliest study of gender preference of children. Since then, more and more studies have been conducted. Researchers have found that there are a lot of reasons behind the phenomenon of gender preference. They include education background, income and social status of fathers and mothers, religious, cultural factors and even government policies. Since those underlying factors vary across different countries, different countries have different degrees of gender preferences. Among 31 developing countries, Cleland, Verrall and Vaessen (1983) identify four groups in terms of the intensity in their desire for the next child to be of a particular sex (quoted from Li 1998). As shown in table 16, the four groups are "strong son preference", "son preference", "no gender preference" and "daughter preference". Generally speaking, countries in the Middle East and South Asia have stronger son preference. Southeast Asian countries and countries in the south to Sahara have son preference or no gender preference. Latin American countries and Caribbean countries have no gender preference (Li 1998).

The above classification depends on the desired sex of the next child of households only. Some studies identify gender preference by such proxies as the sex ratio at birth (such as Abeykoon 1995; Park and Cho 1995), the effects of sex-mix of children on fertility (such as Larsen, Chung, and Gupta 1998), the

difference in the treatment towards male and female children (such as Sen 1984), human capital investment (Davies and Zhang 1995) and mortality rate between the two sexes (such as Murthi, Guio and Dreze 1995; Ram 1984; Rosenzweig and Schultz 1982).

Abeykoon (1995) studies the situation regarding sex preference for sons in four South Asian countries, namely Bangladesh, India, Pakistan and Sri Lanka. He finds out that only Sri Lanka has no son preference in general and the gender preference in Bangladesh, India and Pakistan is realized through post-natal discrimination against female children. The relatively high status of women in the society in Sri Lanka is the main reason for the non-existence of son preference.

Park and Cho (1995) find out that there is a close relationship over time between the sex ratio at birth and the family size in Korea. The smaller the family size, the higher is the sex ratio at birth. The interpretation is that when the family size is small, households have greater concern over the sex of their children and will do more to control the sex to satisfy their desire of the gender composition of children. There seems to be pre-natal discrimination in Korea. They estimate that the "missing girls" due to selective abortion may be up to 5 per cent of the actual female births. Larsen, Chung and Gupta (1998) find out that Korean women with a son are less likely to have another child, and even if they do progress to have next child, they take longer to conceive the subsequent child.

Sen (1984) looks at the issue from the angle of intra-family disparities. Since a household is composed of members of a family, the issue of resource allocation

within a household exists. According to the data quoted by Sen, men are entitled to more calories and protein than women in Matlab of Bangladesh regardless age.[11]

Davies and Zhang (1995) set up a household's utility maximization model with bequests and human capital investment on children. With the use of the data from a 1989 retrospective survey in five villages in Philippines, they find out that "in almost all cases pure preference for male children leads to higher consumption for sons than daughters".

Murthi, Guio and Dreze (1995) use India's data to show that variables related to women's agency such as the female literacy rate and the female labor force participation rate have a strong negative impact on the female disadvantage. Meanwhile, modernization and the general level of economic development of the society have no influence on the female-male survival rate.

Arnold, Choe and Roy (1998) estimate the effects of family composition on parity progression and child mortality in India with a hazard model. Their results suggest that son preference has an adverse effect on both fertility behaviors and sex differentials in child mortality.

An important reference for this thesis is an article of Rosenzweig and Schultz (1982). With the help of child mortality and child survival data in India, they build a utility-maximization model on the intra-family resources allocations

[11] The study about the mortality of children is a sub-set of the treatment towards children. It is because the difference in child mortality is usually associated with how households treat their children. Children may die as suffering from malnutrition and lack of care.

incorporating both the psychological satisfactions of parents from having children and the pecuniary transfer of children to parents. They estimate the following econometric equations.

$$S = \beta_0 + \beta_1 E_m + \beta_2 E_f + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \mu$$

with

$$E_m = \delta_{m0} + \delta_{m1} X_1 + \delta_{m2} X_2 + \delta_{m3} X_3 + \delta_{m4} X_4 + \varepsilon_m$$

$$E_f = \delta_{f0} + \delta_{f1} X_1 + \delta_{f2} X_2 + \delta_{f3} X_3 + \delta_{f4} X_4 + \varepsilon_f$$

where,

S = the difference in levels of sex-specific survival

E_m = the future earnings opportunities of a daughter as a adult

E_f = the future earnings opportunities of a son as a adult

X_1 = vector of variables influencing the demand for adult labor services

X_2 = vector of variables which may act to constrain adult employment

X_3 = vector of wealth, production, or asset variables

X_4 = vector of variables representing educational attainment

In this model, economic factors influence gender preference in terms of resources allocation to sons and daughters. Even without any difference in the psychological satisfaction that households derive from sons as opposed to daughters, the survival rate may still be different for the two sexes. In so far as the pecuniary transfer from a son is different from that of a daughter, the resources distributed to sons and daughters would still be different. Applying rural India's data to the econometric model, the authors find out that the survival rate of female children is positively related to the expected contribution of a daughter to the family, indicated by female employment in the model. The survival rate of female children is also positively related to the proportion of

urban area in the district but negatively related to the land ownership.

Based on this model, Ram (1984) analyzes the gender issues across 118 countries. According to his econometric findings, the females' employment is negatively correlated to the male-female survival difference in developing countries and the male participation rate is positively correlated with the male-female survival difference in industrialized countries.

III. 2/ Studies of Gender Preference in the Chinese Mainland

In the Chinese Mainland, the sex ratio at birth has risen since the economic reform. It has attracted many researchers to study gender preference and the reasons behind it. A lot of reasons have been given, such as the female labor participation rate, women literacy, economic development, health care provision and cultural reasons. The following section reviews the findings of previous studies on China's gender bias in so far as they are relevant to our empirical analysis.

III.2.1/ Cost and Benefit of Having Children

Some studies look into the costs and benefits of having children in the Chinese Mainland. Xu (1996) discusses that the amount of support provided by sons is higher than that by daughters. The monetary support from a son is 95.4 Renminbi while that from a daughter is just 65 Renminbi.[12] With the estimated result of the logit model, Xu points out that whether they are living with their parents is the most important factor determining whether a son will support his parents or not. Other factors include marital status, employment in stated owned enterprises, the income differences between the son and parents and son's education level. Factors determining whether a daughter will support her parents include marital status, employment in stated owned enterprises, the income difference between the daughter and parents and the number of children of the parents. According to Xu whether living with parents is the most important factor determining the amount of contribution a son making to their parents. This is also true with respect to daughters. Besides, the higher is the income of a son (a daughter), the greater is his (her) support to the parents.

[12] Authors did not state the unit of time reference.

With the data of a survey conducted in 1992 about the families' economic situation and fertility in 10 provinces, Tian (1993) discovers that the investment of households in a son (both monetary and non-monetary) is higher than that in a daughter while the monetary contribution of a male child is more than that of a female child. On the cost side, the monetary investment toward a son in school is 871 Renminbi while it is 859 Renminbi for a daughter in school. In terms of non-monetary investment, the average number of days of a household spent on a son in school is 15 while they only spent 5 days on a daughter in school[13]. On the benefits side, son's contribution almost doubles the contribution of a daughter.[14] Tian states that the amount of investment towards children reflects the gender preference of households.

Using the data from a survey conducted in some villages in Xian Yang of Shaanxi in 1995, Zhu and Zhang (1996) finds out that the direct cost of having a son is higher than that of a daughter. Table 17 lists the direct costs. Here, direct cost means monetary expenditure on the child. While bearing and rearing a son up to the age 16 costs 30261 Renminbi, a daughter costs 27771 Renminbi. In other words, the cost of having a daughter is 8 percent less than that of a son.

In short, according to these studies, both the cost and benefits of having a son is higher than that of a daughter.

[13] Authors did not state the unit of time reference.
[14]The contribution of a male child is more than that of a female child by 119 Renminbi annually.

III.2.2/ Sex Ratio at Birth

As shown before, the sex ratio at birth has risen quite rapidly, especially since 1985. The ratio is also quite high comparing to other countries. Park and Cho (1995) and Gu and Roy (1995) find out that, in the Chinese Mainland, Taiwan and South Korea, the sex ratios at birth increase with the decrease in the total fertility rates. (Table 2) In other words, the sex ratio at birth is negatively related to family sizes in all three places. Moreover, the higher the birth order, the higher is the sex ratio at that birth order. The above authors suggest that as the family size decreases, the desired gender composition of a family has to be reached with respect to a smaller number of children. Thus the son preference has a more obvious influence on the sex ratio at birth. The relationship between the birth order and sex ratio at birth can hardly be explained by biological reasons. It seems that some households resort to artificial methods such as sex-choice technology to get the desired sex of their children. Li and Monica Gupta (1999) compare sexual discrimination and the survival situation of female children in the Chinese Mainland, India and Korea. They find out that the overall sex ratio in India is lower than that of the Chinese Mainland and Korea as the southern part of India does not have a son preference. However, in the northern part of India, there is strong son preference that can be reflected in the high mortality rate of female children. The increase in the sex ratio in these three countries since the 1980's reflects the use of sex-selective technology. They also point out that economic development and improvement in living standards do not necessarily reduce the son preference. A case in point is South Korea.

The increase in the ratio has been studied by a lot of researchers (such as Gu and Roy 1996; Li, Y. P. 1993b; Ma 1994; Hull 1990; Yan, Mao and Lu 1999). All of

them agree that the sex ratio at birth is too high, compared to the standard in many countries of 107, and there is gender preference in the Chinese Mainland. But they do not all agree on the reasons behind such a high level. There are two proposed channels, namely underreporting of births and sex-selective abortion.

III.2.2.1/ Underreporting

Some researchers discover that there are serious problems in population statistics. Bao (1993) uses the findings of a survey team on the issue of accuracy of birth statistics to show that among the town and villages surveyed in the project, 14.9 per cent of them have rates of underreporting exceeding 10 per cent. (Table 18) 28.16 per cent of the underreporting were deliberate while 47.12 per cent were attributable to mistakes or errors. Does this kind of practice influence the statistics of the sex ratio at birth? That is, is the problem of underreporting of female births more serious than that of male births? According to Gao's estimation (1993), based on the population statistics in 1989, 1990 and the one per cent sample of the 1990 population census, the underreporting rates of male and female children in 1989 are 1.98 per cent and 4.2 per cent respectively. The sex ratio at birth in 1989 should be adjusted down from 114.07 to 111.48. According to the estimation of Tu (1993), the underreporting rates for male and female births in 1989 are 1.8 per cent and 5.1 per cent respectively, and the sex ratio at birth should be down to 110.8. According to Zeng et al. (1993), the underreporting rate for female births more than doubled that of male births in the 1980's. The estimated sex ratios at birth are reported in table 19. They argue that half to 3/4 of the abnormally high sex ratio at birth is due to underreporting. They said that households are willing to bear the penalty of out-of-plan birth in so far as the newly born is a boy who can continue the family line. They are not willing

to report the out-of-plan female births.

However, a survey in the Tian Men city of Hubei province shows that under very intensive monitoring to avoid underreporting, the sex ratio at birth was 155.75 in 1994, higher than 131 recorded in the 1990 population census.[15] Yan, Mao and Lu (1999) quote a survey in the Xian Ning area of Hubei province showing that 77 per cent of underreported births are male. The survey argues that people are not willing to report male births because they would like to have more than one child. Under the one-child policy, people who reported their first child as male are not allowed to have a second child.

As the evidences are quite contradictory, it is hard to take side. First, the estimations of Gao (1993), Tu's (1993) and Zeng et al. (1993) are based on such data as the one per cent sample tabulation of the 1990 population census, which itself may also be subject to the problem of underreporting. What can be sure is that there are inconsistencies among data, even within a survey. Second, although a small sample should be more reliable as it is easier to control the quality, we do not know whether the situations in Tian Men city and Xian Ning city are really representative of the entire Chinese Mainland. Nevertheless, one point is clear – even if we agree that underreporting of female birth is more serious than that of male births, this does not explain the whole story of the sex ratio at birth. For example, as shown in table 19, the adjusted sex ratio at birth is 108.8 in 1986, still higher than 107.

III.2.2.2/ Sex-selective Abortion

[15] See Yan, Mao and Lu (1999).

If miss-reporting does not seem to be the only reason for the high level of the sex ratio at birth, what about sex-selective abortion? In order to let people perform sex-selective abortion, they must have the means to know the sex of their children before they are born. Ma et al. (1998) state that before the 1980's there were some methods to determine a sex of a child before birth, such as blood test for the pregnant woman, but it was expensive, difficult, not popular. They were only conducted in a small number of hospitals because only a few technicians had such kind of knowledge. In addition, they could only be conducted for purely medical reasons. However, Gu and Xu (1994) state that ultrasound B equipment for prenatal sex determination was introduced into the Chinese Mainland at the end of the 1970's and more than 10,000 units are imported in the 1980's. By the mid-1980's, the Chinese Mainland was able to produce the equipment herself. According to their estimation, up to 1994, there were more than 100,000 units of ultrasound B equipment for prenatal sex determination in the Chinese Mainland. They also state that there is a high positive correlation between the amount of equipment and the sex ratio at birth across regions. Also, it is believed that the implementation of the one-child policy increased the demand for such equipment. Ma et al. (1998) use the year 1980 as the watershed for prenatal sex determination in the Chinese Mainland. It is shown in table 20 that the overall sex ratio at birth in 1980-1988 is higher than that in 1970-1979 by about 2.65. By the order of birth, it is obvious that, generally speaking, the higher the order, the larger is the gap between the sex ratios of the two periods.

A lot of studies suggest that sex-selective abortion is the main mechanism through which son preference is translated into the high sex ratio at birth in the Chinese Mainland. According to a study on birth records in hospitals in 29

provinces of the Chinese Mainland over the period of October 1986 to October 1987 and January 1988 to December 1991, Li (1994) finds out that "sex-selective abortion" and "give birth in hospital when the fetus is male" are the main reasons for the high sex ratio at birth, and the higher the birth order the higher is the ratio. Gao, Liu, and Xia (1997) use data from the 1990 Fourth Population Census and the 1995 One Percent Population Sample survey to examine the changes in sex ratio at birth in Beijing. They find out that sex-selective abortion is the main reason.

It seems that these practices are common in both cities and rural areas. Li, Y. P. (1993a) quotes a study conducted from 1986 to 1987 in 8 provinces by Beijing Medical University that the sex ratio of aborted fetuses is 94.6 in cities and 96.8 in rural areas. Both are lower than 103-107, the usual sex ratio at birth.

In short, the problem of the high sex ratio at birth is serious in the Chinese Mainland. Second, there is a problem regarding the accuracy of population statistics that causes difficulties in analyzing sex ratio at birth and related issues like gender preference. Third, sex-selective abortion seems to be one of main channels translating son preference into a high sex ratio at birth.

III.2.3/ Mortality, Conditions for Households to Sign One-child Certificates and Other Related Studies

With the help of data from the one per cent sample tabulation of the 1990 population census, Han and Li (1999) conclude that the mortality risk for female children is significantly higher than that for male children. They use the infant mortality rate as the dependent variable and apply the data to a Cox model to

analyze the factors influencing child mortality rate. Estimated results show that the child mortality rate positively correlates with families that are extended families[16], Han in nationality, with a less educated mother, in the agricultural sector and without a son. For the female children in the second or higher birth order and having no brother, their mortality rate is much higher.

Some researchers discover that there is gender bias towards sons when they analyze the reasons for households to sign one-child certificates. (Arnold and Liu 1986; Zhang and Spencer 1992; Li and Cooney 1993) After signing a one-child certificate, households are given substantial benefits including a child allowance that continues until the child is 14 years old, priority access to school, hospitals, housing, pensions and access to more land in rural areas. If households violate the one-child restriction, they are penalized, possibly leading to a 10 per cent to 20 per cent reduction in income for 7 years. (Zhang and Spencer 1992) Researchers find out that if a household already has a son, the household is more likely to sign a one-child certificate. Households without a son are less willing to sign it, which is an indication of son preference. Zhang (1994) finds out that son preference has little effect on the timing of signing a one-child certificate and suggests that its effect may through other factors such as education and income to take place.

Researchers in other studies, such as fertility in the Chinese Mainland and the effects of the one-child policy on the second and third births, also find some evidence of the existence of son preference. Larsen (1990), Zhang and Spencer (1992), Li and Cooney (1993), Ahn (1994), Qian (1997) and Li and Choe (1997)

[16] Extended family means there are children, parents and grand parents in a family.

find out that households where the first child is female are more likely to have a second child. Zhang (1990, 1994) find out that there is a stopping rule, i.e., after having a certain number of boys, households will stop childbearing. They are also less likely to use contraceptives after the birth of their first child. (Li and Cooney 1993)

A lot of studies support the existence of son preference in the Chinese Mainland. However, the situation in some areas has changed. According to the family planning committee in Jiaozhaou city (1997), the city launched a program called "Three one one" ("San yi yi") in 1991 to tightly monitor the situation of pregnant women and child bearing in families. This program helped to reduce sex-selective abortion and children abandonment. Since then the sex ratio at birth fell from over 120 in the late 1980's to 106 in 1995. The situation changed not only because of tighter control, but possibly also because of economic development, better education of females and raised women's status. Son preference in certain areas seems to be decreasing. Wang (1994) finds out that more women in Beijing prefer daughters rather than sons regardless of the order of birth. So, the degree of son preference can be reduced with a change in economic and social factors.

III.3/ Conclusion

There are a lot of studies about gender preference. If indices like sex ratio at birth or relative survival rate of male and female children are regarded as indicators for gender preference, studies shows that gender preference is influenced by economic, social, cultural factors and even family sizes (such as Rosenzweig and Schultz 1982; Park and Cho 1995). With regard to the studies in the Chinese Mainland, some authors use statistics to discover the existence of son preference such as using sex ratio at birth (such as Gu and Roy 1996; Yan, Mao, and Lu 1999), infant and child mortality (such as Johansson and Nygren 1991; Li 1999), and treatment towards male and female children (such as Wu and Wang 1991). Some studies analyze the cost and benefits of having children (such as Tian 1993; Xu 1996). Some studies find the existence of son preference and discover factors affecting it when they use econometrics models to tackle other issues such as fertility (such as Larse 1990; Zhang and Spencer 1992) and the conditions for signing one-child certificates (such as Arnold and Liu 1986; Zhang and Spencer 1992). These studies provide a lot of valuable information on gender preference in the Chinese Mainland. They provide evidence of the existence of son preference and relate the phenomenon to various factors such as nationality, education of mothers and whether working in the agricultural sector.

Despite the large literature on gender bias, very few studies employ rigorous econometric models to study the factors affecting gender bias in the Chinese Mainland. What we have in mind is the study by Rosenzweig and Schultz (1982) who use the relative survival rate of male and female children in India, which can be regarded as a proxy for gender bias, as the dependent variable to determine

statistically the factors underlying it. The subsequent chapter introduces an economic model similar in spirit to the study of Rosenzweig and Schultz.

Table 16 Gender Preference among 31 Developing Countries

Strong son preference	Son preference	No gender preference	Daughter preference
Pakistan	Lesotho	Kenya	Venezuela
Mauritius	Sri Lanka	Indonesia	Jamaica
Nepal	Sudan	Peru	
Bangladesh	Morocco	Guyana	
Korea	Thailand	Trinidad and Tobago	
Syria	Fiji	Colombia	
Yemen	Malaysia	Paraguay	
Egypt	Dominica	Costa Rica	
Jordan	Mexico	Panama	
		Philippines	
		Haiti	

Source: Cleland, Verrall and Vaessen 1983, Preferences for the Sex of Children and their Influence on Reproductive Behavior. (Quoted from Li 1998)

Table 17 Direct Cost of Having a Son and a Daughter

(in term of Renminbi)

Sex \ period	During pregnancy	Age 0 – 3	Age 3 – 6	Age 7 – 16	Total
Son	1080	3569	3724	21090	30261*
Daughter	1080	2839	3469	17350	27771*

Source: Zhu and Zhang (1996)

* Including the penalty for out-of-plan birth, 339 Renminbi per birth.

Direct cost means all the monetary expenditure on the child.

Table 18 Number of Towns and Villages Underreporting Birth Data

Year	Underreporting rate			
	Below 5%	5% - 10%	About 10%	Overall
1998	27	13	10	50
1989	25	21	6	52
1990	29	10	9	48
1991	28	14	7	49

Source: Bao (1993)

Table 19 Estimated Sex Ratio at Birth

Year	Reported sex ratio at birth	Estimated sex ratio at birth
1983	107.7	106.2
1984	108.3	106.5
1985	111.2	107.8
1986	112.1	108.8
Jan 1987 – Jun 1988	110.0	107.0
Jan 1989 – Jun 1990*	111.4	107.6
Jan 1989 – Jun 1990**	115.4	111.4

Source: Zeng et al. (1993).

Figures from 1983 to Jan 1987 – June 1988 are calculated from the Two-per-Thousand National Fertility Survey in 1988.

* Calculated from the 10% computer tabulation of the 1990 population census.

** Calculated from the 1% sample tabulation of the 1990 population census.

Table 20 Sex Ratio at Birth according to the Order of Birth

Year	Overall	1st order	2nd order	3rd order	4th order	5th and above order
1970-1979	106.31	106.84	104.45	105.89	107.29	107.50
1980-1988	108.96	105.49	110.83	113.94	114.13	115.64

Source: Ma et al. (1998)

* Data is calculated from the Two-per-Thousand National Fertility Survey in 1988.

Chapter IV

Methodology and data

In the last chapter, we reviewed previous studies about gender preference especially in the Chinese Mainland. In this chapter, we first introduce the theoretical framework of gender preference from the economic perspective. Second, within this framework, we build two econometric models to help analyze the gender preference in the Chinese Mainland. Then we will discuss the data set.

IV.1/ Theoretical framework

IV.1.1/ Gender Preference from the Economic Perspective

In this thesis, we study the determinants of gender bias using ideas in the economics of the family first propounded by Gary Becker and many of his followers. In the standard neoclassical model, the household chooses its optimal bundle of consumption goods by maximizing its utility subject to its budget constraint. In a similar vein and within the framework of family economics, the demographic composition of a household, e.g., the number of sons and daughters in a family, is not just biologically determined, but is the result of the household weighing the costs and benefits of having more or less sons or daughters.

Pioneered by Becker (1991), the most basic model for the demand of children postulates a household utility function:

(1) $U = U(n, Z)$

where n is the number of children and Z is a composite consumption good. A typical household then chooses the desired n and Z subject to its budget

constraint:

(2) $P_n \times n + P_z \times Z = I$

where P_n is the shadow price of a child, P_z is the price of the composite good and I is the income of the household.

While the above simple model assumes that children are consumption goods, it is not inconceivable that children are also investment goods whereby parents invest in their children when they are young. In return, the children take care of the parents at their old age.

Without trying to build an elaborate model of gender bias, what follows is a heuristic account of an extension of the above framework that furnishes the foundation for our subsequent econometric analysis. Extending the above framework to the study of gender preference, eq. (1) may be modified so that

(1') $U = U(s, d, Z, \mathbf{SC})$

where s is the number of son, d is the number of daughter and **SC** is a vector of exogenous variables such as social norms, nationalities. A key element of **SC** in the Chinese Mainland is the traditional son preference. In traditional Chinese society, only sons can pass on a family's lineage. There is even a phrase in traditional Chinese families saying that the most serious sin regarding filial piety a son could commit is the failure to propagate the family line. A son is therefore more important than a daughter and a family having at least one son is not an uncommon desire among Chinese families. The social status of man and woman is also important. Given man has a more respected status, e.g., only men are allowed to participate in some ancestor worships, the satisfaction of having a son will be higher.

The budget constraint (eq. 2) may be correspondingly augmented to include shadow price of sons (P_s) and that of daughters (P_d). Given the income level, the price or cost of bearing a child not only limits the consumption level of households but also the number of sons and daughters they are able to bear. There are monetary and non-monetary costs in bearing a child. Monetary cost includes spending on bearing and feeding a child, such as the expenditure on education, food and clothing. Non-monetary cost refers to the potential parental earnings that are forgone, due to time taken in bearing, feeding and generally taking care of a child.

Is there any difference in the price or cost of having a son and a daughter? So far there are still very few related studies on the Chinese Mainland and the statistics available for analysis is not rich. A more fundamental question is whether we can collect a realistic figure about the "true" cost. The data we can collect shows the monetary spending and hours that households invest in their children. These figures itself are influenced by households' gender preference.[17] For example, a household with son preference would buy more toys and spend more time on them. However, the cost of bearing children in our model is the "true" cost, which is free of gender preference. The "true" cost should just reflect the cost incurred by biological reasons, e.g., male requires more food to maintain a healthy condition. As a result, although figures support both the monetary and non-monetary cost of having a male child is higher than that of having a female child[18], we should not take it as the "true" cost. What we know is, the investment

[17] As Tian, X. Y. (1993) said, the amount of investment towards children reflects the gender preference of households.
[18] See Tian (1993), Shi (1995) and Zhu and Zhang (1996).

households are willing to invest on a son is larger than that on a daughter, not the cost of rearing them. There are no solid statistics supporting the premise that the cost of having a male child is higher than that of having a female one. However, as male children in rural areas have to help families with agricultural work while female children perform housework, a male child may costs more in food consumption as the energy used is probably higher than that of a female child.

If a child also contributes to the income of the family (I_s for the expected income contribution of a son and I_d for that of a daughter), then parent's income "I" will have to be suitably augmented. These incomes are defined as money derived from service and income provided by the child. Services include housework and sideline done by the child in his / her childhood. Of course, the guarantee of income during the parents' old age is also an important service provided by children.

There is evidence supporting the view that the return from male children to families is higher than that of female children. The total amount of income return from all children to a family, labeled it as I_c, may be divided into three components, namely the number of children, n, the income of children, I_n, and the proportion of a son's or daughter's income that he or she gives to their parents, let it be v.

$$I_c = \sum_{i=1}^{n} v_i I_i \qquad i = 1, 2, 3 \ldots n$$

where i indicating the order of children, I_i is the income of child at i^{th} order and v_i is the proportion of the income of child at i^{th} order giving to the household

The income of females is less than that of males in the Chinese Mainland (Gu 1994, Lai 1998). However, we do not have data about what proportion of income of males and females give to their parents, v_i. Some surveys do give data about the amount of income children contribute to their parents. The contribution of a male child is normally more than that of a female child. (Tian 1993, Xu 1996) One study even shows that a son's contribution almost doubles the contribution of a daughter. (Tian 1993) While these are just regional samples, in most cases, parents are living with their sons in the Chinese Mainland and so their livelihood is largely dependent on their sons. These findings are probably universal in the Chinese Mainland.

There is a lack of data and it is difficult to convert housework into monetary terms. There is no solid data to compare the value of services provided by a male child and a female child. However, it is worth noticing that households may not regard housework as important as outside work, such as working in factory or the agricultural sector. This is because its output is not evaluated in the market. Households may regard it as a duty rather than as a contribution with monetary value, especially in less developed areas. Female children contribute more to housework than male children do. So, in rural areas, from a household's perspective, the value of services provided by a son may be higher than that provided by a daughter. Therefore, it is very likely that the monetary benefit of having a son is higher than that of having a daughter.

Concerning non-monetary benefit, which directly influences the utility function and is not included in I_s or I_d, children provide psychological satisfaction to

households and its level of satisfaction depends on cultural and social factors stated above. With the traditional Chinese son preference, the psychological satisfaction of having a son is probably higher than that of having a daughter.

In our models, P_s, P_d, I_s and I_d are grouped together as a vector **E** of economic factors.

In so far as population policies restrict the choice of household (e.g., the one child policy), additional constraints may be included. In less developed and highly populated areas such as India and China, population policy is not uncommon. Population policy may be implemented by various means, such as economic incentive and punishment, education, social pressure, supply of contraceptives and even compulsory abortion. Thus, population policy influences households' desired number of sons and daughters not only by imposing a legal constraint, but also through changing the budget constraint, by the monetary benefit and cost, and the utility function, by peer and social pressure. Therefore, population policy (**PP**) is included.

Solving the above model, the demand for sons and daughters then depend on the factors discussed above (i.e. **E**, **SC**, **PP**). In so far as we can construct some proxy for gender bias $\varphi(s, d)$ which in turn depends on "s" and "d", then,

(3) $\varphi(s, d) = f(\mathbf{E}, \mathbf{SC}, \mathbf{PP})$

where

E = vector of variables reflecting the monetary and non-monetary costs of child rearing and their benefits

SC = vector of variables summarizing the effects of culture and social norms

PP = vector of proxies for population policies

We are going to construct proxies for **E**, **SC**, **PP** in the sections for econometrics models.

To sum up, gender preference depends on economic, social and cultural factors and population policies. If the desired number of sons does not equal to that of daughters, we said the household has a gender preference. So, if the desired number of sons is greater than that of daughters, the household has a son preference. Equation (2) is used to analysis gender preference.

In this study, we are more interested in the economic factor and the impact of the population policy. We are going to construct two econometric models to look at the following issues:

1) Do households have gender preference concerning the sex of their children?
2) What are the factors influencing gender preference?
3) What is the impact of the population policy in the Chinese Mainland on gender preference?

As stated in the literature review, previous studies have analyzed gender preference as a by-product when they use econometric models to analyze fertility, likelihood of having a second child, the interval between births and willingness to sign one-child certificates in the Chinese Mainland. Other empirical studies have used such proxies as sex ratio at birth and child mortality rate to show the existence of gender preference. In the subsequent discussion, we use a more direct approach to tackle the issue using indicators for gender preference as the

dependent variables. Two econometric models are constructed to examine the impacts of the various factors on gender bias. This thesis uses data from Gansu province collected in the second phase of the Chinese Mainland In-depth Fertility Survey. (See section IV.2 for more detail)

IV.1.2/ Econometrics Models

Based on the theoretical reasoning in the previous section, we are going to construct two econometric models to analyze gender bias in the Chinese Mainland. To explain the motivations behind these two models, it is perhaps useful to decompose the process of a birth into 3 parts: desires, means and outcome. Desires refer to the household's longing for a son or a daughter. Desires for a son or a daughter may be influenced by a lot of factors that will be discussed below. Given the desires, households need means to fulfill it. The means to achieve the desired composition of children can be classified into three types, namely before pregnancy, during pregnancy and after birth. Before pregnancy, some Chinese may try certain medicine to have the 'right sex' of the future birth. During pregnancy, people may identify the sex of baby and if it is not the 'right sex' the parent may abort the baby. Ultrasound B equipment for prenatal sex determination is now commonly used in the Chinese Mainland as a feasible and reliable mean. After birth, parents could abandon the child or adopt a child to adjust the number of sons and daughters. Households could adjust the number of sons and daughters and their ratio by having more children. This is more effective when the gender preference is in the form of having at least one child with a specified sex, such as a son. We are not going to find out what is the most common means people use to control the sex at birth. Instead, we test whether people have the means, no matter which means, to control the sex at birth.

Keeping the above discussion in mind, the first model examines the factors that contribute to the desire with respect to the preference of sex of the next birth. The result of this model would give answer to what the factors influencing gender

preference and its effects are. In the second model, we try to identify the factors contributing to the actual difference in the number of sons and daughters in a family. The second model is different from the first one, as the dependent variable is no longer an "intention" about gender preference, the desired sex of the next child. It is the actual number of sons and daughters that households have, which is partly influenced by the accessibility of means of controlling sex of children. The result of the second model should provide the information on factors influencing gender preference in term of the actual difference in the number of sons and daughters, and whether population policies have any impact. In both models, the household is regarded as a rational decision making unit.

IV.1.2.1/ Model 1

In the second phase of the Chinese Mainland In-depth Fertility Survey, households were asked about the desired sex of the next birth. We use this as the dependent variable in the econometric model. If we can find a significant relationship between the desired sex of the next birth and independent variables, then, first, the households' desired sex of children is not random. Second, the desired sex of the next child relates to various factors like economics and population policy.

Some of the previous analysis concerning gender preference or fertility (such as Zhang and Sturm 1994; Li and Choe 1997; Larsen et al. 1998) focus on the second birth. However, the gender of the second birth or any order of births may not only reflect the gender preference of a household as it is also influenced by biological effects if the household does not use such effective means as sex selective abortion to control the sex of its children. A household's desired sex of

the next birth purely reflects the gender preference of that household with a minimum of noise. This is the reason why we use it as the dependent variable in the first model.

As the dependent variable is a discrete one and there are three choices, we use a multinomial logit model[19] to examine the influences of different variables on the preference of the sex of the next birth. The theoretical framework of the multinomial logit model is the same as the logit model. The only difference is that there are more than two choices in the dependent variable, rather than two. In our model, there are three choices: (1) no preference in the sex of the next birth, (2) the desired sex of the next birth is male (3) and the desired sex of the next birth is female. [20]

In multinomial logit model, it is assumed that the probability follows a logistic distribution[21]:

$$(4) \qquad \text{Prob}(Y_i = j) = \frac{\exp(\beta_j' \mathbf{X}_i)}{\sum_k \exp(\beta_k' \mathbf{X}_i)} \qquad \text{where } k = 0, 1, \text{ or } 2$$

where

j and k are the alternatives in the choice,

Y_i is the alternative chosen by individual i,

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[19] The foundation of logit model is discussed in more detail in Appendix 2. Moreover, the use of multinomial logit model may involve the issues of Independence of Irrelevant Alternatives (IIA). If it is the case, the odds ratio, $\text{Prob}(Y_1=j)/\text{Prob}(Y_1=k)$ are not independent to other alternatives and the estimates will be inefficient but will not lead to inconsistency. An ordered multinomial logit model be may an alternative as IIA is irrelevant to it.

[20] The three choices are regarding the desire of households for the sex of their next child and those choices are mutually exclusive.

[21] Multinomial Probit model is also capable of discrete dependent variable, but due to the relatively complicated probability distribution, most researchers prefer the logit model. See Thomas (1997) and Greene (1990).

Y_i = 0 means no special gender preference for the next birth;

= 1 means the desired sex of the next birth is male;

= 2 means the desired sex of the next birth is female.

β = a vector of coefficients of independent variables,

$\mathbf{X}_i$ = a vector of independent variables (i.e. **E**, **SC** and **PP** discussed in the previous section).

The logistic distribution is similar to the normal distribution except at the two tails, which are considerably heavier. (Greene 1990) For simplicity, we rewrite equation (4) as:

(4') $\quad \text{Prob}(Y_i = j) = F(\beta'\mathbf{X})$

The log likelihood, estimated logit model is:

(5) $\quad \ln L = \sum_i \sum_{j=0}^{2} d_{ij} \ln \text{Prob}(Y_i = j) \qquad$ where j = 0, 1, 2

For each individual, i, d = 1 if alternative j is chosen by the individual i, and 0 otherwise.

Recall equation (4'), the predicted probability is $F(\beta'\mathbf{X})$. Therefore the estimated marginal effects are equal to $d\text{Prob}(Y)/d\mathbf{X}$ or $F'(\beta'\mathbf{X})\beta$, or $f(\beta'\mathbf{X})\beta$. We must be careful not to use β as the vector of estimated marginal effects of the corresponding variables. There are three choices in our model, so the estimated marginal effect of a variable is the change in the probability with respect to a given choice due to a marginal change in the variable. For example, the estimated marginal effect of female education level on the choice of having a girl as the desired gender of the next birth is 0.04. It means a marginal increase in the

female education level increases the probability of a household hoping to have a girl for the next birth by 4 per cent.

In this model, other than **E**, **SC**[22], the independent variables also include **Ch**, a vector indicating the existing gender composition of children in a family. **Ch** is included because that a household's desired sex of the next child is probably influenced by the sex of the children it already has. For example, if the son preference is not very strong, a household that already has a son may want to have a daughter. If a household already has two or more sons and no daughter, the family likely prefers a daughter rather than a son. So, **Ch** is included to identify this.

As a result, equation (4') can be rewrote as:

(4'') $\text{Prob}(Y_i = j) = F(\mathbf{E}, \mathbf{SC}, \mathbf{Ch})$

The list of variables and their expected values are in the table 21. Here we discuss it one by one.

*IV.1.2.1a/ Variables in the Vector **E***

There are four important variables we would like to discuss first. These are the education level and occupation of the wives, and their husbands. We must be careful in interpreting the coefficient of education level. Different interpretations with respect to the marginal effects of education levels are conceivable. The

[22] In model 1, there is no independent variable indicating the population policy as when the survey asked respondents about their desired sex of the next child, it was 1987. All decisions about the desired sex of the next child are under the influence of the population policy, esp. the one-child policy, which started to implement in 1979. In model 2, there is a variable for the population policies.

education level of the wives (husbands) may be used as proxies for the expected income contribution of a daughter (a son) to the parents respectively ($\mathbf{E}_f$ and $\mathbf{E}_m$). As stated in section IV.1.1, one important variable explaining the desire of having sons or daughters is how much their sons and daughters will contribute financially to the family. However, in reality, households do not have this information, as they do not know their children's income in future and what proportions of their children's income will be given to them. What they can do is to guess based on available information such as the average wage rate of male and female in the society and their own wages. On this matter, previous studies tried different proxies for the financial contribution of children. For example, Rosenzweig and Schultz (1982) consider using regional wage rate and employment level of both sexes as the proxy.[23] An alternative is the wages of the women and their husbands.[24] Unfortunately, all the above proxies are not available. Without a better choice, education levels of parents are used as the proxies in our estimation model.[25] There are, however, caveats with the use of education levels as proxies. As stated by Zhang (1990, 1994), the education level is probably associated with other factors that may influence gender bias. Education may instill people with the concept of gender equality and change their attitudes towards the equal rights of males and females. Education may therefore help reduce one's gender bias. (For the sake of simplicity, we refer to this effect of education as the "pure education effect" in the rest of this thesis.) This is the reason why we put these variables under both categories of

[23] They finally use regional employment level as the proxy as "wage rates may not accurately reflect the shadow value of times because exogenous cultural factor may prevent wives from equalizing market and household marginal products" and "agricultural wage rates are not available for many districts of India". (Rosenzweig and Schultz 1982)

[24] Respondents here mean the respondents of the second phase of the Chinese Mainland In-depth Fertility Survey and all of them are women.

[25] In some studies, education is used as a proxy for potential wages. See Zhang (1990, 1994).

"economic" and "social and cultural" in table 21.

At this stage, we expect that the education of women is positively related to the probability of hoping the next child to be a girl. This is because, first, as a proxy for their daughters' income, the higher the income, the higher the monetary support they guess their daughters will contribute. Secondly, the higher the education level of women, the higher is the probability that they accept the concept of equal rights for men and women.[26] [27]

On the other hand, the impact of the education level of respondents' husbands is more complicated. First, the higher the financial contributions of sons, the higher is the probability that they hope their next child to be a boy. However, according to the pure education effect, with a higher level of education, the probability of hoping their next child to be a boy should be lower. Therefore, there are counteracting effects and the net effect of the variable can only be empirically determined.

The variables for the occupation[28] of the respondents and their husbands are also included as proxies for the expected income contribution of a son and a daughter respectively. Generally speaking, the income of non-agricultural work is higher than that of agricultural work. This is the reason why a lot of people flow from

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[26] Han and Li (1999) find women's education helps to improve the survival rate of female children which can be regarded as an indictor for gender preference.

[27] Some literature find that higher the education level of people, the fewer is the number of children they would like to have, as higher education level means higher opportunity cost of bearing and rearing a child. However, this argument is not relevant to our model as we are using the desired sex of next child as the dependent variable, which implicitly assumes they would like to have the next birth. In fact, we only include observations that have stated that they would like to have a next child. This point will be also discussed in the end of this chapter.

[28] For the dummy variable "respondent works in the non-agricultural sector" and "respondent's husband works in the non-agricultural sector", 0 means one is unemployed or works in the

rural areas to urban areas to seek jobs in factories each year. As stated above about the education levels, parents may use their own income as an estimation for the future support of their sons and daughters to them. The estimated income for daughters by females working in the non-agricultural sector may be higher than that by females working in the agricultural sector. Therefore, respondents working in the non-agricultural sector should be more likely to desire a daughter as their next birth. By the same token, respondents' husbands working in the non-agricultural sector should be more likely to desire a son as their next child.

To capture the income effect on the desired sex of the next birth, we include the household annual income and proxy variables, i.e. variables for the ownership of durable goods, including washing machine, sewing machine, refrigerator and television. Using ownership of durable goods as a proxy for lifetime income is supported by the theoretical literature relating to the socio-economic theory of fertility behavior (e.g. Zhang, 1990, 1994). We expect income to be positively related to the probability of desiring a girl as the next child. This is because rich people may be able to pay the penalties for having more children, thereby giving room for the births of girls as they need not satisfy their son preference in only one or two births.

*IV.1.2.1b/ Variables in the Vector **Ch***

There are two variables in the vector **Ch**: (1) "the difference in the number of sons and daughters", i.e., s – d, and (2) the dummy variable for households without children[29]. The first variable captures the information of the sex

agricultural sector, 1 means one works in the non-agricultural sector.

[29] For this dummy variable, 0 means the household has at least one child and 1 means the household has no child.

composition with respect to the existing children. For example, if there are two sons and a daughter, this variable will take the value of one. The reason we do not use the number of sons and daughters to replace this variable is that what we want to gauge is the effect of sex composition of existing children, not individual impact the number of sons and daughters taken separately[30]. For example, regardless of whether the composition is "two sons and one daughter" or "only one son", our variable will assume the value of one and what we are actually interested in is the impact of this difference. However, if the number of sons and daughters are equal, the variable will take a value just equal to the case of "no children". To avoid this, we introduce the dummy variable "the household without living children". We anticipate that: (1) if the number of daughters is larger than that of sons, it is more likely that the household would prefer a son as the next child and vice versa; (2) given the prevailing son preference, if a household has no children, it will prefer a son as the next child.

IV.1.2.1c/ Variables in the Vector ***SC***

We include the age of respondent and her husband at the time when the data in the survey was collected. The aim of including these demographic variables is to look at the relationship between age and gender preference. In our expectation, younger people should more likely to have modern sense of gender equality than older people, and be less influenced by traditional son preference. Therefore, we expect younger people will have less son preference and be more likely to desire a daughter as their next child than the older people.

[30] There is also a technical issue when we use three dummies, i.e., (1) only has sons, (2) only has daughters and (3) has both sons and daughters, to represent the combination of children. The iteration process of the multinomial logit model does not convergent.

We also include the nationality of couples to find out whether the more lenient population policy towards ethnic minorities has any impact on gender preference of next birth. With this unequal degree of restriction of the population policies, people with Han nationality are expected to be more likely to desire a son as their next child.[31] Of course, the traditional view of gender in different ethnic groups may be different and also have impact on our estimations. Unfortunately, we do not have any information about it.

The degree of enforcement of the one-child policy is different in rural as opposed to urban areas. This is due to the different costs of enforcement and monitoring, since the population is less concentrated and the cost of implementation is thus relatively higher in rural areas. The low level of economic development also means fewer resources for family planning authorities to implement the policy. Banister (1987) pointed out that the economic rewards from signing the one-child pledge were so much less in countryside comparing to that in cities. So, people in rural areas have less incentive to obey the one-child policy and therefore may have more children. This gives room for the birth of daughters. However, the traditional Chinese preference for sons is relatively strong in rural areas. As this preference is so strong, its influence may outweigh the influence of relatively lax enforcement of the one-child policy. The inclusion of the places of residence, namely, "living in cities" and "living in towns" of the respondents as dummy variables in **SC** is to examine these counteracting effects. The reference group pertains to households living in rural areas.

[31] Han and Li (1999) finds women belong to ethnical minority associate with a higher survival rate of female children which can be regarded as an indictor for gender preference.

The sample in this model only includes observations for married women with a desire for future birth. The reason for excluding unmarried women is that the decision on the sex of the next child, in most cases, is determined by both husband and wife, and the husband's family may also influence the decision. Unmarried women are different from married women because their decisions are not influenced by their husbands and the husband's family.[32] Besides it is obvious that we should not include households that do not desire future children.

[32] We have also run the econometric model including unmarried women. However, this only adds one more observation to our sample. The results are listed in Appendix 3.

IV.1.2.2/ Model 2

While model 1 looks into those factors influencing gender preference, model 2 examines not only those issues addressed by model 1, but also the impact of the population policies and the existence of the means to control the sex composition of children. While model 1 focuses on determinants of the desired sex of the next child, model 2 explores the impacts of various factors in affecting the actual sex composition of children in a family. Therefore, the dependent variable is no longer the desire for the sex of children, but the actual gender composition of children in a family.

The second phase of the Chinese Mainland In-depth Fertility Survey provides us with the actual number of sons and daughters of each respondent for the construction of the dependent variable of the model. With this information we can construct three indicators for gender bias, φ (s, d). The first is ratio of sons to daughters or the inverse (s / d or d / s). The second is the ratio of sons to all children, or the ratio of daughters to all children (s / (s + d) or d / (s + d)). And the third is the difference between the number of sons and the number of daughters (s – d).

The first and second indicators are ratios and they have their own shortcomings. The first indicator, s / d or d / s, has the problem of being undefined when the denominator is zero, e.g., the case of having no children or only having sons or daughters. If we delete all those cases, we will lose a lot of information. For the second indicator, the ratio of sons to all children or the ratio of daughters to all children (s / (s + d) or d / (s + d)), we may also lose useful information. For example, there are two families, one with four sons only and one with one son

only. The indicator, s / (s + d), for the two cases takes the value of "one". However, do these cases really mean there is no difference for our purposes? It seems the former family has a stronger son preference than the latter one. Such an indicator may be misleading. The third indicator, (s – d), does not have the above problems. We therefore use the difference between the number of sons and the number of daughters as the dependent variables in model 2.

In a situation where the gender preference does not exist, nothing other than biological factors would influence the sex composition of children in a family. Thus the regression coefficients of all independent variables will be insignificant. Yet, as is probably the case in the Chinese Mainland, some socioeconomic variables as well as population policy may exert influence on the gender composition of children in a family. Recall equation (3),

(3) $\varphi(s, d) = f(\mathbf{E}, \mathbf{SC}, \mathbf{PP})$

With the difference in the number of sons and daughters as the dependent variable, we postulate a linear OLS regression model and the equation to be estimated is,

(6) $(s - d) = \beta_0 + \beta_1\mathbf{E}_m + \beta_2\mathbf{E}_f + \beta_3\mathbf{SC}_m + \beta_4\mathbf{SC}_f + \beta_5\mathbf{Ch} + \beta_6\mathbf{PP} + \mu$

where $\mathbf{E}_m$, $\mathbf{E}_f$, $\mathbf{SC}_m$, $\mathbf{SC}_f$, **Ch**, **PP** are vectors and β_i(i = 1, 2...6) are their corresponding vectors of coefficients.

The independent variables in this model and their expected signs are listed in table 22. Since some of the independent variables are the same as those in model 1 and the reasons for including them were discussed (section IV.1.2.1), here we only discuss those variables that are not included in model 1 unless there are additional remarks with respect to those variables appearing.

IV.1.2.2a/ Variables in the Vector ***PP***

There are several independent variables related to the one-child policy. The first is the dummy variable for families having their first child after 1979. The Chinese government adopted the one-child policy in 1978, and it was formally announced in January 1979. Generally speaking, households could no longer satisfy their boy preference by increasing the number of children. Instead, they need to satisfy their boy preference within one or two births. In such circumstances, if boy preference really exists and people have the means to influence the sex of births or the death of their children, the difference in the number of sons and of daughters should be influenced by the one-child policy. Theoretically, as boy preference exists, the difference should become larger. So we include this dummy variable to capture this effect and expect that it is positively related to the difference in the numbers of sons and daughters.

The second is the dummy variable based on the question "local representatives talked to you about how many children you should have" in the questionnaire of the survey.[33] This variable relates to the monitoring of household's fertility behaviors by local governments and the strength of implementation of the one-child policy. Its impact on the dependent variable is, however, not clear. On the one hand, if the policy is implemented strictly and allows households to have only one child, people with a strong son preference will try their best to have a son. On the other hand, with strict monitoring over family planning issues, including the use of ultrasound B equipment for prenatal sex determination, it is

[33] For this independent variable, 0 means no local representatives had talked to the respondents about how many children she should have, and 1 means local representatives had talked to the respondents about that.

much more difficult for households to control the sex of their children. Under the quota of one child (or two if the first child is a daughter in some rural areas), households may end up with only daughters as a result. As the survey did not ask respondents in greater detail about the implementation of family planning policy, it is hard for us to theoretically determine the sign of the variable as there are counteracting forces.

IV.1.2.2b/ Variables in the Vector ***E***

In this model, the variables for the education level of respondents and their husbands may serve as proxies for the estimated contribution of sons and daughters to households, as in model 1. It is, however, can conceivable that the variables for education in this model are associated not only with the pure education effect (see section IV.1.2.1a) but also with the accessibility of the means for controlling the sex of birth. This is because being better educated may have more knowledge about the means, e.g. ultrasound B equipment and abortion. Therefore, we have to be careful about interpreting the coefficient of education level.

In order to find out whether implementation of the one-child policy changes the influence of respondents' and their husbands' education level on gender preference, we include two interactive variables. They are (1) the product of the dummy variable for the one-child policy (family having their first child after 1979) and the respondent's education level and (2) the product of the dummy variable for the one-child policy and the husband's education level. With the implementation of the one-child policy, the number of children of a household is legally restricted, households need to be more calculating about the sex of their

children if they have gender preference and want to realize it. Besides, the relation between education level and rewards from work should be stronger as a result of the economic reforms and the introduction of the market mechanism since 1979. Therefore, the influence of their education level, as an estimated income contribution of a son and a daughter to households, may become larger. In other words, we expect the interactive variable corresponding to the wife's education level to be negatively related to the dependent variable, while the interactive variable with respect to the husband's education level is positively related to the dependent variable.

The variables for household annual income and other proxy variables, i.e. durable goods, are included to capture the income effect. There are counteractive forces pertaining to the income effect. First, rich people may be able to pay the penalty for having more children. Therefore they could satisfy their desire to have a son by having more children until there is a son. The number of female children may also increase. Second, an increase in income may also render sex-control methods such as the ultrasound B equipment more accessible. A richer family may utilize some sex-control methods to satisfy its son preference without violating the one-child policy. Third, Rosenzweig and Schultz (1982) show that higher income levels increase the survival rate of daughters at their early age in India. If this holds in the Chinese Mainland, higher household income may increase the number of daughters in a family. However, as the health and medical system at the local level in the Chinese Mainland is quite sound that the infant mortality rate is kept in a quite low level, the effect in the study of Rosenzweig and Schultz (1982) may perhaps be insignificant in our estimation. To sum up, the direction of the income effect in this model can only be empirically

determined.

IV.1.2.2c/ Variables in the Vector ***Ch***

There are some other variables in this model not included in model 1. The number of children is one of these independent variables. As stated above, people may increase the number of children to satisfy their desire to have at least one son although this violates the one-child policy. With a larger number of children, there is more room for the birth and survival of daughters. We expect this variable be negatively related to the dependent variable. [34]

IV.1.2.2d/ Variables in the Vector ***SC***

We include variables indicating the age of both men and women when they had their first child and their last child. The aim of including demographic variables is to look at the relationship between age and the gender preference. The age at the first child may reflect the impact of socioeconomic status of a person. Traditionally, Chinese get married when they are very young and have children very soon for the purpose of family propagation. As career prospects get brighter, people may get married and have their first child relatively later. As a woman gains brighter career prospects, and hence higher social status and earnings, she may regard females as having the same ability and value as males, thereby reducing the boy preference. By the same token, we include the age of man when they have their first child and their last child. We expect men who have their first child at an older age will have a greater boy preference.

[34] Park and Cho (1995) state that their findings seem to suggest that when the family size is small, households have greater concerns over the sex of their children and will do more in controlling the sex to satisfy their desire of the sex combination of children.

A dummy variable indicating whether the household is living with their parents is also included. The older generation should have a stronger boy preference. If a household lives with them, their son preference should have larger impact on the household's decision on the gender composition of children.[35] They may ask the household to have at least one son to continue the ancestral line. Therefore we expect this variable to be positively related to the dependent variable.

Finally, dummy variables for the place of residence of both respondents and their husbands during their childhood are included.[36] Easterlin (1969) states that one's taste is developed throughout his life, including the childhood period. If this is true, it should be true for one's gender preference too. In order to capture such information, we include these variables in our model. As the son preference is stronger in rural areas, we expect people living in rural areas in their childhood to have a stronger preference for sons.

Since some of the variables we use are just proxies, we may have the problem of measurement errors. Taking education level as an example, we use it to be a proxy for the contribution of a son and a daughter to the income of the household. However, as it is a proxy, it may suffer from measurement error. Econometricians prove that when committing measurement error, the least-squares estimates of the regression parameters will be biased and inconsistent. The degree of bias and inconsistency relates to the variance of the measurement error. One technique to solve the problem is instrumental-variables estimation, that involves the search for a new variable that is highly correlated with the

[35] Han and Li (1999) find that the female child mortality rate is higher for those girls living in extended families.
[36] Zhang (1990) also uses this kind of variables in estimating the fertility in China.

independent variable and at the same time not correlated with the error term in the equation. However, due to the limited choice of variables in the database, we cannot use the instrumental-variables estimation. Using parents' education level as a proxy for the contribution of a son and a daughter is the best way we have so far.

In this model, we only include observations with respect to those respondents who have stated that they did not want a next child, had not remarried and had at least one child. The reasons for using such a truncated sample are as follows. First, if a household wants to have an additional child[37], its present children's gender composition may not reflect its gender preference. If we include this type of households in our estimation, the result may not be reliable. Second, if a respondent had remarried, she may have brought children with her to join the new family and we are not sure of the impact of such children on the household's desired sex composition of children. For example, a man may still want his own son even if he married a woman with a boy, so that this household may end up with two sons. If we take the difference in the number of sons and daughters as an indicator for gender preference, this type of households seems to have a stronger son preference than households with only one son. However, such a man may want only one son if marrying a woman with no child. Therefore, remarriage may create problems with the indicator for gender preference.[38] Third, not wanting any children does not necessarily mean no gender bias. A household may prefer a boy rather than a girl while it actually wants no children. However the indicator of gender preference, i.e., the difference in the number of sons and

[37] There is a question that did respondents honestly answer the question of whether they like a next child. Under the population policy, there are penalties on people violating the one-child policy. Some respondents may just answer no to avoid any troubles.

[38] We have also done estimation with the observations with remarriage. The results are listed in

daughters, takes the same value in the case of no child and having the same number of sons and daughters. While the latter implies no gender preference, the former, in fact, gives no information about the gender preference of a household.

Appendix 3.

IV.2/ Data

This thesis uses data from Gansu province collected in the second phase of the Chinese Mainland In-depth Fertility Survey, conducted in February 1988 by the State Statistical Bureau of PRC with the assistance of the International Statistical Institute Research Center. The survey includes the following provinces: Liaoning, Shandong, Guangdong, Guizhou, Gansu and Beijing. We choose Gansu province for our empirical analysis as its son preference in term of the sex ratio at birth and the level of its economic development is lower. (See table 9 for the sex ratio at birth in different provinces) If economic factors really influence gender preference in Gansu, they should also be influential in gender preference in other provinces where are with a stronger son preference and higher levels of economic development, where the impacts of economic factors may be stronger.

There are 5751 observations in the database from Gansu province. In model 1, as we only include respondents want a next child and exclude those observations with missing values for some independent variables, the sample size then reduces to 1670. In model 2, we only include respondents indicating that they do not want any more children, had not remarried and have at least one child. The sample size reduces to 3417. The sample statistics for these three samples' sizes are listed in table 23, 24 and 25 respectively.

For the variables of the respondents' husbands' age when the first and the last children were born, there seems to be some errors in the database. We find out that, after calculation, two husbands have their first child before they themselves were born; 9 husbands had their first child before age 15; and one man had his first child when he was aged 2. As we already excluded observations who had

remarried, this is not the result of children being brought in by remarried women. This is an error in collecting data. To avoid the impacts of these errors on our estimation, we have excluded those 11 observations.[39]

[39] We have run the estimation without the variables for the men's age when their first and last children were born and so including those 11 observations. The results are shown in Appendix 3.

Table 21 List of Variables in Model 1

Types of Variables	Variables	Expected sign (Y=1)	Expected sign (Y=2)
Ch	Difference in the number of sons and daughters	Negative	Positive
Ch	Household without children*	Positive	Negative
E & SC	Respondent's education level	Negative	Positive
E & SC	Respondent's husband's education level	-	-
E	Respondent works in the non-agricultural sector	Negative	Positive
E	Respondent's husband works in the non-agricultural sector	Positive	Negative
E	Household annual income	Negative	Positive
E	Washing machine*	Negative	Positive
E	Sewing machine*	Negative	Positive
E	Refrigerator*	Negative	Positive
E	Television*	Negative	Positive
SC	Respondent's age	Positive	Negative
SC	Respondent's age**2	-	-
SC	Respondent's husband's age	Positive	Negative
SC	Respondent's husband's age**2	-	-
SC & PP	Respondent's nationality is Han*	Positive	Negative
SC & PP	Respondent's husband's nationality is Han*	Positive	Negative
SC & PP	Living in cities*	Negative	Positive
SC & PP	Living in towns*	Negative	Positive

Key: **Ch**: Variables indicate the sex composition of children; **E**: Economic variables; **SC**: Social and Cultural variables; **PP**: Population policy variable;

* Dummy variables

Table 22 List of Variables in Model 2

Types of variables	Variables	Expected sign
PP	Having the first child after 1979*	Positive
PP	Local representatives talked to you about how many children you should have*	-
CH	Number of children	Negative
E & SC	Respondent's education level	Negative
E & SC	Respondent's husband's education level	Positive
E	Household annual income	-
E	Washing machine*	-
E	Sewing machine*	-
E	Refrigerator*	-
E	Television*	-
SC	Respondent's age when the first child was born	Negative
SC	Respondent's age when the last child was born	-
SC	Respondent's husband's age when the first child was born	Positive
SC	Respondent's husband's age when the last child was born	-
SC	Respondent lived in city in her childhood*	Negative
SC	Respondent lived in town in her childhood*	Negative
SC	Respondent's husband lived in city in his childhood*	Negative
SC	Respondent's husband lived in town in his childhood*	Negative
SC	Household living with elderly parents*	Positive
SC & PP	Respondent's nationality is Han*	Positive
SC & PP	Respondent's husband's nationality is Han*	Positive
SC & PP	Living in cities*	-
SC & PP	Living in towns*	-

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Table 22 - continued

Types of variables #	**Variables**	**Expected sign**
Interactive variable (**SC** & **E**) * **PP**	Education level of respondent who had her first child after 1979	Negative
Interactive variable (**SC** & **E**) * **PP**	Education level of respondent's husband's who had his first child after 1979	Positive

Key: **PP**: Population policy variable; **Ch**: Variables indicate the sex composition of children; **SC**: Social and Cultural variables; **E**: Economic variables

* Dummy variables

Table 23.a **Sample Statistics of the Database of Gansu**

Variables	Mean	Standard deviation	Range	
			Minimum	Maximum
Number of child	2.51465	1.59394	0	10
Difference in the number of sons and daughters	0.11570	1.53992	-6	6
Respondent's age	32.52122	8.50864	15	49
Respondent's husband's age	36.36364	9.39380	15	85
Respondent's education level	2.91172	4.07124	0	16
Respondent's husband's education level	6.03249	4.25178	0	16
Household annual income	1325.65984	1373.15898	11	24000

Sample size: 5324[40]

[40] Since there are missing values for some observations, the sample size is reduced from 5751 to 4799.

Table 23.b Sample Statistics of the database of Gansu

(Frequency)

Variable	Frequency
Having the first child after 1979 or no child yet	2176
Respondents have remarriage	198
Household without children	525
Local representatives talked to you about how many children you should have	2147
Respondent works in the non-agricultural sector	608
Respondent's husband works in the non-agricultural sector	1423
Washing machine	597
Sewing machine	2207
Refrigerator	45
Television	1303
Household living with elderly parents	4432
Respondent's nationality is Han	4861
Respondent's husband's nationality is Han	4878
Living in cities	497
Living in towns	217

Sample size: 5324

Table 24.a Sample Statistics of the Sample for Model 1

Variables	Mean	Standard deviation	Range	
			Minimum	Maximum
The desired sex of next child	0.98263	0.62526	0	2
Difference in the number of sons and daughters	-0.17246	1.11484	-6	3
Household without children*	0.30120	0.45892	0	1
Respondent's education level	4.01856	4.39241	0	16
Respondent's husband's education level	7.09820	4.01405	0	16
Respondent works in the non-agricultural sector	0.11257	0.31617	0	1
Respondent's husband works in the non-agricultural sector	0.26048	0.43903	0	1
Household annual income	1271.95569	1362.97186	25	24000
Washing machine*	0.095808	0.29442	0	1
Sewing machine*	0.34611	0.47587	0	1
Refrigerator*	0.0047904	0.069068	0	1
Television*	0.20539	0.40411	0	1
Respondent's age	24.74910	5.68010	15	49
Respondent's age**2	644.76228	330.64023	225	2401
Respondent's husband's age	28.17485	6.57842	15	85
Respondent's husband's age**2	837.07186	444.27227	225	7225
Respondent's nationality is Han*	0.87964	0.32548	0	1
Respondent's husband's nationality is Han*	0.88204	0.32266	0	1
Living in cities*	0.085629	0.27990	0	1
Living in towns*	0.041317	0.19908	0	1

Sample size: 1670

* Dummy variables

Table 24.b Frequency for Dummy Variables in Model 1

Variable		Frequency
The desired sex of next child:	No preference	341
	Boy	1017
	Girl	312
Household without children		503
Respondent works in the non-agricultural sector		188
Respondent's husband works in the non-agricultural sector		435
Washing machine		160
Sewing machine		578
Refrigerator		8
Television		343
Respondent's nationality is Han		1469
Respondent's husband's nationality is Han		1473
Living in cities		143
Living in towns		69

Sample size: 1670

Table 25.a Sample Statistics of the Sample for Model 2

Variables	Mean	Standard deviation	Range	
			Minimum	Maximum
Difference in the number of sons and daughters	0.24583	1.68628	-6	6
Having the first child after 1979*	0.18584	0.38903	0	1
Local representatives talked to you about how many children you should have*	0.36670	0.48197	0	1
Number of children	3.20983	1.31628	1	10
Respondent's education level	2.41264	3.82278	0	16
Respondent's husband's education level	5.61399	4.24105	0	16
Household annual income	1353.41557	1388.54246	11	24000
Washing machine*	0.12262	0.32805	0	1
Sewing machine*	0.44454	0.49699	0	1
Refrigerator*	0.010828	0.10351	0	1
Television*	0.26719	0.44256	0	1
Respondent's age when the first child was born	20.49839	2.68574	14	39
Respondent's age when the last child was born	27.76695	4.35927	16	45
Respondent's husband's age when the first child was born	24.33714	3.99786	16	77
Respondent's husband's age when the last child was born	31.85533	5.34416	18	82

(Continued on next page)

Table 25.a - continued

Variables	Mean	Standard deviation	Range	
			Minimum	Maximum
Respondent lived in city in her childhood*	0.058531	0.23478	0	1
Respondent lived in town in her childhood*	0.021071	0.14364	0	1
Respondent's husband lived in city in his childhood*	0.072871	0.25996	0	1
Respondent's husband lived in town in his childhood*	0.027802	0.16443	0	1
Household living with elderly parents*	0.81621	0.38737	0	1
Respondent's nationality is Han*	0.93503	0.24651	0	1
Respondent's husband's nationality is Han*	0.93854	0.24020	0	1
Living in cities*	0.098332	0.29781	0	1
Living in towns*	0.038338	0.19204	0	1
Education level of respondent who had her first child after 1979	0.78578	2.62326	0	16
Education level of respondent's husband's who had his first child after 1979	1.47820	3.51405	0	16

* Dummy variables

Sample size: 3417

Table 25.b Frequency for Dummy Variables in Model 2

Variable	Frequency
Having the first child after 1979	635
Local representatives talked to you about how many children you should have	1253
Respondent lived in city in her childhood	200
Respondent lived in town in her childhood	72
Respondent's husband lived in city in his childhood	249
Respondent's husband lived in town in his childhood	95
Washing machine	419
Sewing machine	1519
Refrigerator	37
Television	913
Household living with elderly parents	2789
Respondent's nationality is Han	3195
Respondent's husband's nationality is Han	3207
Living in cities	336
Living in towns	131

Sample size: 3417

Chapter V

Estimated Results

There are four sections in this chapter. In the first section, we use the two indicators for gender preference to see whether gender bias exists in our sample. Then we discuss the estimated results of the two models in the following two sections. Finally, there is a conclusion for this chapter.

V.1/ Proxies for Gender Preference

Before going into the two gender preference indicators, we look at the overall number of sons and daughters of our data set. The whole population of our database consists of 5751 observations with 14443 children. Among them, 7544 are boys and 6899 are girls. The sons to daughters ratio is 109.3. This is a quite high value because if there was no gender preference, it should be very close to 100.

If there was no gender preference, we do not expect there to be a very large difference in the desired sex of next child, although it could be affected by the gender composition of existing children. For the sample in model 1, there are a total of 1670 observations. 341 respondents reported that they have no sex preference. 1017 prefer boys while 312 prefer girls. This means that 61 per cent of respondents prefer boys while only 20 per cent of them prefer girls. (Diagram 3) The number for boys is threefold that for girls. This shows a strong son preference.

In model 2, we use the difference in the number of sons and daughters as an

indicator for gender preference. If there is no gender preference, the indicator for average should take the value of zero. If this indicator take a positive value, there is son preference and vice versa. The average difference in the number of sons and daughters in the sample for model 2 is 0.24583. This indicator also supports the existence of son preference. To sum up, all the indicators seem to suggest that there is a son preference in our sample.

V.2/ Estimated Results of Model 1

The estimated results of model 1 are listed in table 26 and table 27. Before looking at the marginal impact of each independent variable on the desired sex of the next child, we first look at the overall reliability of the model. The likelihood ratio of the estimated model is listed at the bottom of the table 26. The likelihood ratio (LR) takes the following form:

LR = -2(ln Lr – In L)

where "Lr" and "L" are the log-likelihood functions evaluated on the restricted and unrestricted model respectively. The unrestricted model is the model with the probability equation as equation (4').

$Prob(Y_i = j) = F(\beta'\mathbf{X})$ where $\mathbf{X} = (\mathbf{E}, \mathbf{SC}, \mathbf{Ch})$

The restricted model is the model that assumes the coefficients of all independent variables are equal to zero. The LR test is just like an F test in that all of the slopes of a regression are zero. The LR of model 1 is 1317.456 and this is significant at the one percent level. Therefore, the hull hypothesis that all of the slope coefficients are zero is rejected. In other words, the gender preference is not a random phenomenon, but is influenced by various factors. We will discuss those in detail.

Concerning the goodness of fit of our model, there is no R-square statistics for the logit model. The likelihood ratio index (LRI), defined as 1 – ln L / ln Lr, seems to be an alternative for the goodness of fit test. Its value lies within the range of zero and one. A value of zero means all slope coefficients are zero while a value of one means the model is a prefect fit. However, a value of one in fact implies that at least one of the independent variables, after some transformation,

is identical to the dependent variable, otherwise, it is impossible to make the LRI equals to one. In this case, it is a flaw in a model and a fatal error is committed. On the other hand, any value between zero and 1 has no natural interpretation. Therefore, the likelihood ratio index is not very useful.[41] The LRI for model 1 is 0.419692. Since this is between zero and one, it has no natural meaning.

In order to find out how good our model is and choose the best one from different specifications, the "hit-and-miss" table is used. A "hit-and-miss" table records the actual choice of each observation and compares it with the one predicted in the estimated model. With the estimated coefficients, the probabilities of each alternative for each observation can be calculated. In our model, these alternatives are "no sex preference", "boy" and "girl" for next birth. The alternative with the greater probability is regarded as the predicted choice in the estimated model. Table 27 is the "hit-and-miss" table for model 1. For example, among the 1138 cases predicted to prefer a boy as their next child, 928 actually preferred a son. The correct prediction rate for boy is 81.55 per cent. Among that 1138 cases, 196 and 14 cases actually chose "no sex preference" and "girl", but our model predicts them as preferring "boy". The failure rate for boy is then 18.45 per cent. The correct prediction rates, stated in the last column of the table 27, for the three alternatives are 48.72, 81.55 per cent and 63.00 per cent respectively. Therefore, our model is good at predicting the preference for boy and poor for "no sex preference". The overall correct prediction rate is 74.97 per cent.[42]

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[41] See Greene (1990).

[42] The LRs and "hit-and-miss" tables for other specifications of model 1 are listed in Appendix 3.1.

Table 26 reports the estimated marginal effects of each independent variable and their t-statistics. As stated in the methodology chapter for model 1, in the multinomial logit model, the marginal effect is not $\underline{\beta}$, but is $F'(\underline{\beta}'\mathbf{X})\underline{\beta}$. In table 26, the column "dProb(Y=1)/d**X**" is the marginal effect of each independent variable on the probability of preferring a son as the next child; "dProb(Y=2)/d**X**" is the marginal effect of each independent variable on the probability of preferring a daughter as the next child. The reference group is the probability of having no sex preference with respect to next child.

*V.1.2a/ Economic Factors (**E**)*

The estimated results of the education levels of women are not entirely in accordance with our expectations. As stated already, there may be two effects captured by the variable: one effect pertains to the expected contribution of a daughter; the other is the pure education effect. Both effects should reduce son preference. However, according to our estimation, education levels of women and whether women work in the non-agricultural sector has no impact on gender preference. Such a finding possibly implies that women's earning ability seems to have no impact on the gender preference indicated by the desired sex of the next child. While we assumed that a household is a rational decision-making unit in which a woman's earning ability may play a similar role to that of husband with respect to the desired sex of the next child, it is perhaps not inconceivable that a family can also be regarded as a unit in which the distribution of power among household members is uneven. (See Sen 1989) Women may then have little say in decision making.

Men's education and their occupation have impacts on gender preference. The

higher the education level of man, the greater is the probability of the household preferring a daughter as the next child. Men working in the non-agricultural sector increase households' probability of preferring a boy as their next birth. As stated before, education may capture both the effects of the expected contribution of a son as well as the pure education effect. While occupation could only reflect the effect of the expected contribution of a son, the empirical results may mean two things. First, the higher the expected contribution of a son, the higher is husbands' son preference. Second, regarding the impact of man's education, the pure education effect outweighs the effect of the higher expected contribution of a son to the household.

The income effect, which is reflected by the sign of the variables of annual income and durable goods in this model, is quite clear. The higher the income level, the lower is the probability of preferring a son as the next child and the higher is the probability of preferring a daughter. Perhaps it is because households with higher income are willing to pay the penalty for having more children, giving more room to the births of daughters as households need not to satisfy their son preference in only one or two births.

*V.1.2b/ Sex Composition of Children (**Ch**)*

The sign of the coefficient of the difference in the number of sons and daughters fits with our expectation: if the number of daughters is larger than that of sons, it is more likely that that household prefers a son as the next child and vice versa. The above empirical finding seems to suggest that most Chinese consider optimal to have both sons and daughters.

Given the prevailing son preference, we expect that if a household does not have children yet, a son is preferred as the first child. However, the estimates suggest that households without children tend to have no sex preference for their next child. This is shown by the negative sign of the coefficient of "households without children" on both probabilities for hoping next birth being a son and being a daughter.

*V.1.2c/ Social and Cultural Factors (**SC**)*

We expected that younger people have less son preference as they are less influenced by the traditional social norm of son preference. However, according to the estimation, the older the wife, the higher is the probability the household desires a daughter as its next birth[43]. The younger the husband, the more likely that he has no sex preference.[44] Although younger men are less likely to prefer a girl as the next child, this is still in line with the expectation that the young have less son preference. The question, then, is what causes young women to be less likely to prefer a girl as the next child. Our estimation does not provide an answer. However, one possible reason is that, in the Chinese Mainland, younger women are more likely to be influenced by family planning policy through campaigns, education and administration channels. For example, women aged below 20 when the survey was conducted should have learned family planning policy during their schooltime; family planning workers are also more likely to put more effort on women aged around 20 to 30 as those women are more likely to get married and give birth. As stated already, the family planning policy,

[43] The probability is increasing in a decreasing rate. The estimated marginal effect of the square of the wife's age is – 0.0003.

[44] The probability is decreasing in a decreasing rate. The estimated marginal effects of the square of the husband's age on both probabilities for desiring a son and a daughter are negative in sign.

especially the one-child policy, strengthens the son preference in people.

The place of residence is significant in our estimation. First, compared to those living in rural areas, people living in cities are more likely to prefer a daughter as the next child. Second, compared to those living in rural areas, living in towns decreases both probabilities for preferring a son and a daughter, and increases the probability of having no gender preference. These results seem to suggest that, comparing with people living in cities, the effect of the strong traditional boy preference outweighs the impact of relatively lax enforcement of the one-child policy in rural areas.

Next, if the wife is Han in nationality, the household is more likely to desire a boy as the next birth. However, if the husband is Han in nationality, the probability of desiring a son as the next child falls. The magnitude of the wife's coefficient is larger than that of the husband. Therefore, comparing with a family with non-Han couple, a Han household has a higher probability of desiring a son as the next child.

In this model, we estimated the impacts of various factors on the desired sex of the next child and we find out that gender preference is influenced by various factors. Regarding the contribution of children to households, while the expected daughter's contribution may not influence the gender preference, the expected son's contribution does. Our estimation suggests that the higher the expected son's contribution, the stronger is the son preference. When the income of a household increases, it is able and more willing to pay the penalty for having

more children, it is less keen to desire its next child as a boy. Therefore its son preference is weaker.

V.3/ Estimated Results of Model 2

As in the previous section, we discuss the empirical findings from model 2 and go through the effects of the independent variables on the sex composition of households. The estimated results are listed in table 28.

*V.1.3a/ Economic Factors (**E**)*

In model 2, the education level of wives is insignificant while the variable capturing the interaction between the wife's education and having the first child after 1979 is negatively significant, i.e., the higher the education level of women having the first child after 1979, the lower is household's son preference.

According to the estimated results, one further year of education for women having their first child after 1979 reduces the difference in the number of sons and daughters by 0.038. The average number of year of wives' education in our sample is about two and a half, and the average difference in the number of sons and daughters is 0.246. Then, the son preference implied by the difference could be eliminated if the average number of year of wives' education could be raised to about nine years.

There are two possible reasons why the education of wives is only significant with respect to those households having their first child after 1979. First, those households having their first child after 1979 are more influenced by the one-child policy as all of their children were born under the policy. They may be more calculating in the decision of having how many children and the gender composition of children, as there are rewards and penalties of the population policies. Therefore, the expected contribution of children becomes more

important. As the expected contribution of a daughter increases (implied by a higher education level of wives), households' son preference becomes weaker and the difference in the number of sons and daughters becomes smaller. Second, the economic rewards of education have become greater as the economic reform in the Chinese Mainland started in 1978. Before the economic reform, jobs and wages were allocated and determined by the government as there was no free market. One's reward for work was not in accordance with to one's productivity in a planned economy. The effect of getting more education, and so being more productive, might play no role in the decision about the gender composition of children. Therefore, the economic effect of education of women is only effective in the households having their first children after 1979, as all their children were born under the one-child policy and economic reform. On the other hand, the pure education effect seems to be ineffective, as the education level of wives is insignificant.[45]

Next, the education level of men is significant no matter whether they have their first child before or after 1979. However, the impacts are different. The sign of the coefficient of the education of men is negative[46], i.e., reducing the son preference, and the sign of coefficient of the education of men having their first child after 1979 is positive, i.e., increasing the son preference. Why do they have opposite effects? As stated in the methodology chapter, education for men may have counteracting effects: (1) the pure education effect, i.e., the positive influence of education on one's perception of gender equality; (2) the effect of a higher expected contribution of a son to households. Similar to the argument for

[45] The proposed last effect of education, i.e., an increase the accessibility of means controlling the sex of children, helps the households realize their gender preference about the sex of children.
[46] This result is similar to the result in model 1.

female's education above, the variable for men's education for those having the first child after 1979 captures the effect of economic reform and the one-child policy that take place after 1978 and 1979. The variable of men's education captures the pure education effect. Then, one possible explanation is that, the economic effect of education is not effective until the economic reform launched in 1978. The total effect of education is the sum of "men's education" and "men's education of those having their first child after 1979". The coefficient of "men's education" is –0.021 and the coefficient of "men's education of those having their first child after 1979" is 0.044. Therefore, the total effect of men's education on the gender preference implied by the difference in the number of sons and daughters is 0.023. One more year of men's education will increase the difference by 0.023.

The income effect is not clear according to our estimations. Two variables for the income effect are significant, namely "annual income" and "refrigerator". While higher annual income increases the son preference, the ownership of a refrigerator reduces it. As mentioned already the income effect is mixed. Therefore, we cannot make any conclusion for the income effect on the difference in the number of sons and daughters.

*V.1.3b/ Population Policies (**PP**)*

Other than the two interactive variables just discussed, there are two variables about the one-child policy. One is "having the first child after 1979" which captures the effect of the implementation of the one-child policy. Although this variable is insignificant, the interactive variables with the education level of both women and men are significant as discussed above. This suggests that the one-

child policy influences the difference in the number of sons and daughters indirectly through education.

The variable for the monitoring of households' fertility behaviors by local governments is negatively significant, i.e., it narrows the difference in the number of sons and daughters. As stated in the methodology section (*IV.1.2.2a*), this variable may influence the gender composition of children through strict quota of children and through strict monitoring over various techniques for family planning, e.g., the use of ultrasound B equipment for prenatal sex determination. The former strengthens households' son preference, as households have to satisfy their son preference within one or two births. The latter reduces the household's manipulation of the sex composition with respect to its children. With the prevailing son preference, a stricter control of the techniques should reduce the difference in the number of sons and daughters. Therefore, the negative sign of the variable may imply that the latter effect outweighs the former.

*V.1.3c/ Sex Composition of Children (**Ch**)*

The coefficient of the number of children is significant. As expected, the sign is negative. This supports the argument that people may increase the number of children to satisfy their desire to have at least one or more son, and that there are more room for the birth and survival of daughters in a family with a larger number of children. This points out the dilemma between population control by birth quota, i.e. one-child policy, and the balance of males to females. The more restrictive the limitation on the number of children in a family is, the more imbalanced is the male to female ratio. According to the estimated results,

theoretically, having one more child could reduce the difference in the number of sons and daughters by 0.21. As the average number of children in our sample is 3.2, this means that allowing households to have about 4 children may eliminate the son preference in terms of the number of sons and daughters.

*V.1.3d/ Social and Cultural Factors (**SC**)*

The sign of the coefficient of the variable for households living with their elderly parents is negative. This means that households living with parents will result in a lower boy preference. This result is not in line with the findings of Han and Li (1999). Their results suggest the son preference in families with elderly parents is stronger, as the female child mortality is higher in those extended families. It seems that the effect of living in extended families on gender bias has to be further studied.

Our estimated results show that "living in cities" is insignificant while "living in towns" is negatively significant, implying the son preference of people living in towns are weaker than those living in rural areas. There are conflicting effects of the variables for the place of residence as stated before. On the one hand, the enforcement of the one-child policy is lax in rural areas. On the other hand, there is a stronger boy preference in rural areas. The result of "living in towns" may be because the influence of stronger boy preference outweighs the influence of relatively lax enforcement of the one-child policy in rural areas comparing to those living in towns.

Unlike the result of Han and Li (1999), the nationality of a household has no impact on gender preference. The insignificance of nationality of the parents

indicates that the more lenient population policy towards ethnic minorities by government may not have significant impact on gender preference.

Besides, the living place of wives and husbands in their childhood and their ages when the first and last child were born are also insignificant. The insignificance of the living place in wives' and husbands' childhood implies that the theory of Easterlin (1969) about one's taste being developed throughout his life including his childhood period may not be valid concerning gender preference in our sample. The insignificance of the age of wives and husbands when the first and last child were born suggests that it has no impact on the difference in the number of sons and daughters.

V.4/ Conclusion for the Estimated Results

Researchers have done a lot of work about gender preference in the Chinese Mainland. Some of them simply compile summary statistics to find out the existence of son preference. Others provide evidence of the existence of son preference and identify the underlying factors when they analyze issues such as fertility and the conditions for signing one-child certificates. Some studies analyze the costs and benefits of having children. All these studies furnish a lot of valuable information on gender preference in the Chinese Mainland. Findings on gender bias are, however, just by-products of these studies. Very few econometric studies actually analyze the determinants of gender preference in the Chinese Mainland using proxies of gender bias as the left-hand-side variable. Our study therefore complements previous studies and suggests directions for further studies.

This thesis uses the data from Gansu province collected in the second phase of the Chinese Mainland In-depth Fertility Survey conducted in 1988 to analyze the gender preference in the Chinese Mainland. By using different proxies for gender preference, our empirical findings suggest that households do have a son preference in support of many previous studies.

The desired sex of the next child is used as the dependent variable in model 1 while the difference in the number of sons and daughters is used as the dependent variable in model 2. The econometric findings of model 1 and 2 suggest that economic, social and cultural factors and population policies have impacts on gender preference. Some of the findings of the two models are different, but we have to bear in mind that the dependent variables of the two models are not the

same, they measure gender preference in different aspects. The findings seem to suggest that the expected contribution of children is effective in influencing the sex of children. For example, the education of wives is not significant in model 1, but its interactive variable with households having their first child after 1979 in model 2, which concerning the actual sex combination of children, is significant. The income effects in the two models are also different. It may be because that in model 2, the income effects include the accessibility of means controlling the sex of children while it is not included in model 1.

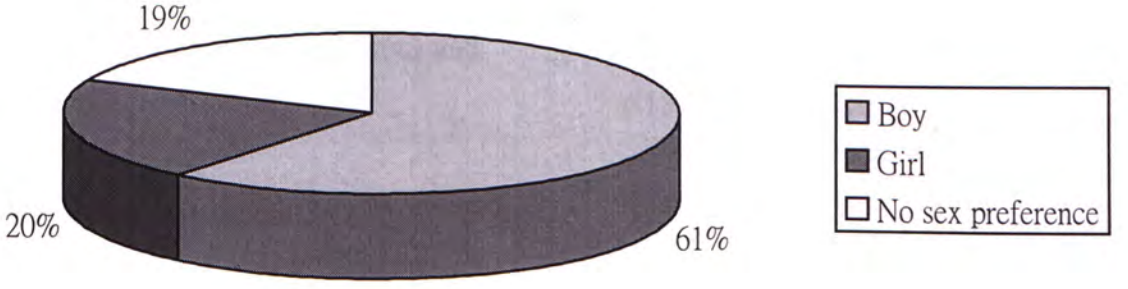
The significance of variables in model 2 suggests that households have the means to control the gender composition of children. The significance of variables related to the one-child policy also indicates that the population policy does influence gender preference of households. It also reinforces the effect of the expected income contribution of children on gender bias.

The second model also provides evidence of the dilemma between population control and son preference. Estimated results suggest that with more children, the preference for sons becomes less intense. Our results are consistent with the findings of Park and Cho (1995) on Korea. To ameliorate these adverse effects of the one-child policy, measures such as pension system and the provision of economic rewards to people following the one-child policy should be given more attention.

As stated before, some of the independent variables in the two models are proxies and thus problems pertaining to measurement error may exist. However, there are no better alternatives provided in the data set. For example, better

proxies for the expected income contribution of children, such as the wages of wives and husband, should be very useful in getting a more accurate picture about gender bias though our data set does not have this kind of information. Our findings are therefore preliminary. There is much room for improvement when more data are available.

Diagram 3 Desired Sex of the Next Child



Source: Gansu province collected in the second phase of the Chinese Mainland In-Depth Fertility Survey conducted in 1988

Sample size: 1670

Table 26 Estimated Results of Model 1

Variables	dProb (Y=1)/dx	dProb (Y=2)/dx
Constant	0.79219	-0.26695
	(3.88240)	(-0.668860)
	***	
Difference in the number of sons and daughters	-0.29462	0.21054
	(-13.7647)	(7.49845)
	***	***
Household without children	-0.067849	-0.063209
	(-4.84392)	(-2.79246)
	***	***
Respondent's education level	-0.0007198	0.0020673
	(0.054450)	(1.10063)
Respondent's husband's education level	-0.0015354	0.0028141
	(-0.149248)	(1.29722)
		*
Respondent works in the non-agricultural sector	0.014348	-0.0020065
	(0.287367)	(0.036712)
Respondent's husband works in the non-agricultural sector	0.053105	-0.0067055
	(1.99605)	(0.269368)
	**	
Household annual income	-8.39960D-06	-5.24549D-06
	(-1.72267)	(-1.12330)
	**	
Washing machine	-0.068540	0.077436
	(-0.785606)	(2.05200)
		**
Sewing machine	-0.045989	-0.0019255
	(-2.54690)	(-0.882263)
	***	

(Continued on next page)

Table 26 - continued

Variables	**dProb (Y=1)/dx**	**dProb (Y=2)/dx**
Refrigerator	-0.29754	0.12508
	(-1.47322)	(0.690932)
	*	
Television	0.0085746	0.035287
	(0.866788)	(1.87095)
		**
Respondent's age	-0.015704	0.019815
	(-0.501534)	(1.41793)
		*
Respondent's age**2	0.00017246	-0.0003312
	(0.135733)	(-1.49540)
		*
Respondent's husband's age	-0.025122	-0.013227
	(-2.28588)	(-2.00972)
	**	**
Respondent's husband's age**2	0.00044060	0.00022055
	(2.37648)	(2.16450)
	***	**
Respondent's nationality is Han	0.32307	-0.046474
	(2.07321)	(0.257024)
	**	
Respondent's husband's nationality is Han	-0.24182	0.038006
	(-1.53174)	(-0.156432)
	*	
Living in cities	-0.093908	0.072338
	(-1.12635)	(1.49250)
		*
Living in towns	-0.035731	-0.054860
	(-1.33852)	(-1.82494)
	*	**
Likelihood ratio	1317.456***	

*** 1% significant level

** 5% significant level

* 10% significant level

Table 27 "Hit and Miss" Table for Model 1

		Actual			Total	Correct Prediction rate
		0	**1**	**2**		
	0	38	28	12	78	48.72%
Predicted	**1**	196	928	14	1138	81.55%
	2	107	61	286	454	63.00%
Total		341	1017	312	1670	

Percent of overall correct prediction: **74.97%**

Alternative: 0 = no sex preference

1 = boy

2 = daughter

Table 28 Estimation Results of Model 2

Variables	Coefficient	t-statistic
Constant	2.55853	7.46372***
Having the first child after 1979	-0.121798	-0.928237
Local representatives asked about children	-0.109835	-1.86982**
Number of children	-0.207119	-4.50735***
Respondent's education level	-0.177723E-02	-0.153671
Respondent's husband's education level	-0.020510	-2.27852**
Household annual income	0.512548E-04	1.98492**
Washing machine	0.046956	0.377056
Sewing machine	0.042169	0.651621
Refrigerator	-0.382655	-1.43089*
Television	-0.099838	-1.26292
Respondent's age when the first child was born	0.018271	0.321437
Respondent's age when the last child was born	-0.050985	-0.901843
Respondent's husband's age when the first child was born	-0.036684	-0.642825
Respondent's husband's age when the last child was born	0.026015	0.454422
Respondent lived in city in her childhood	-0.201077	-1.22381
Respondent lived in town in her childhood	0.198547	0.841352
Respondent's husband lived in city in his childhood	-0.175712	-1.19730
Respondent's husband lived in town in his childhood	0.190281	0.845750
Household living with elderly parents	-0.177650	-2.25734**
Respondent's nationality is Han	-0.296958	-0.712237
Respondent's husband's nationality is Han	0.359600E-02	0.838445E-02
Living in cities	-0.050453	-0.303334
Living in towns	-0.461540	-2.17144**

(Continued on next page)

Table 28 - continued

Variables	**Coefficient**	**t-statistic**
Interactive variables		
(Respondent's education level) * (Having the first child after 1979)	-0.038416	-2.49893***
(Respondent's husband's education level) * (Having the first child after 1979)	0.044195	2.73791***
Mean of dependent variable	0.245830	
Adjusted R-square	0.037853	
F-statistic (zero slopes)	6.37568***	

*** 1% significant level

** 5% significant level

* 10% significant level

Chapter VI

Conclusion

The alarming increase in the sex ratio at birth, often attributed to the population policy and prevailing son preference, has been one of the major concerns over the population in the Chinese Mainland of many researchers. Analyzing gender bias and its underlying causes is an essential task in order to control population growth without unwanted and perverse consequences. In this thesis, we aim at finding out (1) whether son preference exists; (2) the factors underlying son preference and the magnitudes of their impact; (3) the impact of population policy.

We review the history of the population policy in the Chinese Mainland since 1949 and the literature about gender preference. Population policies had not been consistently implemented before the 1970's due to changes in political climate. As the huge and rapidly growing population became a burden to "four modernization" campaign, the government introduced the one-child policy in 1979. The policy seems to be effective. Population targets were met and the total fertility rate dropped even below the replacement level.

However, undesired consequences accompany those successes. The sex ratio at birth, relative mortality rate for infant females to males and the number of girl abandonment have increased. A shortage of women in marriage market and such crimes as abduction are foreseeable. The problems inadvertently introduced by the population policy must be seriously addressed.

There is no doubt a large amount of literature on gender preference. Causal analyses with the help of using such indicators of gender preference as the sex ratio at birth or relative survival rates of male and female children, suggest that gender preference is influenced by economic, social, cultural factors and family sizes. Many contributions have been made in those works. However, few econometric studies have used indicators for gender preference as the dependent variable to analyze the determinants of gender preference in the Chinese Mainland.

One contribution of this thesis is the use of a rigorous economic framework to study gender preference. To be more specific, two econometric models using the desired sex of the next child and the difference in the number of sons and daughters as the dependent variables are introduced. These models are then estimated with the help of data from Gansu province collected in the second phase of the Chinese Mainland In-depth Fertility Survey conducted on 1988.

The estimated results suggest that: (1) son preference does exist; (2) economic, social and cultural factors and population policy have impacts on gender bias; (3) there is a dilemma between population control and son bias. The one-child policy has been quite successful in limiting the growth of population. But the existence of son preference leads to problems like high sex ratio at birth and abandonment of female infants. It also reduces the effectiveness of the population policy, as some people choose to go against the one-child policy.

What should be done to improve the situation? In the analysis of the second model, we have found that if the number of children increases, the gender

preference will decrease. Relaxing the one-child policy should also help to lower the sex ratio at birth and number of abandoned girls. If the one-child policy is to go on some more years, it is certain that the social dependency rate[47] of the population will increase and aging issues will emerge as fewer children will be born every year. Relaxing the one-child policy could also solve these problems. However, what would be the impact of such a change? Although the fertility rate has fallen below the replacement level, we do not know the extent to which it is influenced by the one-child policy. Will fertility drastically jump if the one-child policy is replaced by, say, a two-child policy? A lot of very careful studies must be done before relaxing the one-child policy.

As the findings show, economic reasons are among the important factors behind gender bias as households not only regard children as consumption goods, but also as investment goods. Increase in the expected contribution of a daughter will reduce the son preference. Income for work is an essential element of the expected contribution of a child. However, in fact, there is evidence that women and men are not treated equally in economic aspect such as the compensation in the workplace. There is a survey showing that women are less favored than men in the workplace. (Wang 1994) Some analysts even find out that women are the first to lose their jobs and last to be rehired. (South China Morning Post, March 10, 1999) Since the expected contribution of females to households influences the choice of the sex of their children, this kind of discrimination may be pertinent to the issue of the sex ratio at birth. The economic inequality between the sexes should be addressed. The introduction of regulations against sexual discrimination should be considered carefully. At the same time, developing a

[47] See Appendix 1 for its definition.

market economic system including the labor market is also essential. This is because a well-developed market economy rewards people according to their market value rather than to their gender.

Education is a very important means to increase one's productivity. According to our estimated result, if women receive more education, the son preference will be reduced. However, in our sample, women only received 3 years of education on average, while the figure is 6 years for men. (Table 25.a) According to the China Statistical Yearbook 1999, 63 per cent of people who educated up to college level and higher are male, while the illiteracy rate for males aged six or over is 8.1 per cent, that for females is 19.5 per cent. The inequality of education between the two sexes is very clear and serious. This is the result of son preference and in turn it reinforces the son preference. To close the earning gap between men and women, inequality in education between the two sexes must be addressed and improved. Education also helps to eliminate son preference by introducing the concept of gender equality. We proved that this effect could reduce the gender preference in model 1. Therefore helping girls to receive more education is an urgent task. This is especially true in rural and poor areas as the inequality usually is greater in those areas. In some poor areas, households only send boys to school as they cannot afford to send all their children.

Old age security is one element of the contribution children make to their parents. As sons rather than daughters traditionally support their parents at old age, people prefer sons rather than girls. A pension fund can help as it can secure people's old age without relying too much on their children. Although the intention to build a social security system has been announced for many years

and some pilot programs in some areas (shi dian) have been established, the government has really done very little due to the inadequate funding. Social security is still quite limited.

According to our models, the income effect may reduce the gender preference. Economic development in a region may thus be beneficial to gender equality. In the poorer areas, helping the poor to improve their earning ability will help. Family planning should be implemented with policies helping the poor such as introducing better seeds and agricultural products with higher economic value.

As gender bias is partly the result of low women status, raising the status of women in society would help. The value of housework should be addressed as women do most of it. Women in a traditional Chinese family only bear the responsibility of house keeping. However, the value of housework is not fully recognized since it is hard to value in monetary terms. In western countries, the value of housework is recognized as there are markets for it, such as markets for domestic helpers and baby-sitters. Their wages reveal the value of housework. The political status of women should also be addressed. Although there are some women in the upper layers of the political institution of the Chinese Mainland, many of the important posts are held by men. Women having more power in the political area would raise the women status and help to reduce the son preference.

The above pertains to the long term solutions addressing gender bias. However, as the inequality is severe, some short term measures should be considered. As shown in model 2, stricter monitoring of people's fertility behaviors may help.

For example, the tightening of the control of family policy in Jiaozhao city of Shandong reduces the sex ratio at birth, although tighter monitoring cannot change the gender preference. (Family Planning Committee of Jiaozhao city, 1997) It may also help reduce the number of abandoned girls if the monitoring is strict enough. But it will be very costly especially in terms of manpower. Banning the use of ultrasound B equipment for prenatal sex determination may also be effective in reducing the sex ratio at birth. However, as pointed out by Goodkind (1996), tighter monitoring on prenatal sex selection may lead to postnatal discrimination, which should also be avoided.

In short, to implement the population policy with less adverse effect, we suggest: (1) in the long run, the education and social status of women should be improved and a sound social security system should be established; (2) enacting regulation against sex discrimination should be considered; and (3) as the short term means, strict monitoring of peoples' fertility behaviors should be considered.

Appendix

Appendix 1. Definition of Indicators[48]

1.1/ Sex ratio at birth (SRB)

SRB refers to the ratio between the total number of male born in a period over total number of female in the same period.

$$SRB = \frac{S_i}{D_i}$$

where S_i = total number of male born in a specified period i

D_i = total number of female born in a specified period i

1.2/ Fertility rate

Fertility rate refers to the ratio of the number of births (usually per year) per 1000 women of childbearing age, usually 15 – 44.

$$\text{Fertility rate} = \frac{\text{number of births}}{\text{number of women}} \times 1000‰$$

[48] References for this section are China Statistical Yearbook 1998 and the web page of the Department of Economic and Social Affairs of the United Nation Population Division (http://www.undp.org/popin/).

1.3/ Total fertility rate (TFR)

Total fertility rate refers to the summary overall measure of fertility obtained by summing the age specific fertility rates for each year of the childbearing span, usually 15 – 44.

$$TFR = \sum AFR_i$$

where

$$AFR = \frac{\text{total number of births to women aged i}}{\text{total number of women aged i}} \times 1000‰$$

AFR is age-specific fertility rate referring to the ratio of total number of birth to women at a specified age over the total number of women at the same age during a certain period of time (usually a year), which is often expressed in ‰.

1.4/ Birth rate

Birth rate refers to the ratio of the number of births to the average population during a certain period of time (usually a year), which is often expressed in ‰.

$$\text{Birth rate} = \frac{\text{number of births}}{\text{average number of population}} \times 1000‰$$

1.5/ Death rate

Death rate refers to the ratio of the number of deaths to the average population during a certain period of time (usually a year), which is often expressed in ‰.

$$\text{Death rate} = \frac{\text{number of deaths}}{\text{average number of population}} \times 1000‰$$

VII.1.6/ Natural growth rate of population

Natural growth rate of population refers to the ratio of the number of natural increase in population (number of births minus number of deaths) in a certain period (usually a year) to the average population of the same period, which is often expressed in ‰.

$$\text{Natural growth rate of population} = \frac{\text{number of births - number of deaths}}{\text{average number of population}} \times 1000‰$$

1.7/ Social dependency ratio (SRS)

Social dependency ratio refers to the ratio of the number of dependents to the total number of social laborers.

$$\text{SRS} = \frac{\text{number of dependents}}{\text{total number of social laborers}} \times 100\%$$

Appendix 2. Multinomial Logit Model[49]

In some cases the dependent variables may be discrete ones, such as "yes" or "no". To deal with such kind of variables, a qualitative model must be used. Logit model is one of it. The basic formation of a logit model is a binary choice model, i.e. the dependent variable only take two value.

For example, buy a car (Y=1) or not (Y=0). It is considered that a set of factors should have influence on the decision, such as income, price of car, price of gasoline. So that,

Prob (Y=1) = F(β'**X**)

Prob (Y=0) = 1 - F(β'**X**)

Where β & **X** are vectors

The probability model become,

E[y] = 0 [1-F(β'**X**)] + 1[F(β'**X**)]

= F(β'**X**)

In a logit model, the probability follows a logistic distribution,

$$\text{Prob}\,(Y=1)=\frac{\exp(\beta'\mathbf{X})}{1+\exp(\beta'\mathbf{X})}$$

$$\text{Prob}\,(Y=0)=1-\frac{\exp(\beta'\mathbf{X})}{1+\exp(\beta'\mathbf{X})}$$

The estimation model is a log likelihood model,

[49] The main reference for this appendix is Greene (1990) and Thomas (1997).

$$\ln L = \sum_i [y_i \ln F(\beta' \mathbf{X}) + (1 - y_i) \ln (1 - F(\beta' \mathbf{X}))]$$

Both the predicted probabilities, $F(\hat{\beta}'\mathbf{X}) = F_p$, and the estimated marginal effects, $f(\hat{\beta}'\mathbf{X})(\beta) = f\hat{\beta}$, where $\hat{\beta}$ is the estimated β in the above log likelihood model, are nonlinear functions of $\hat{\beta}$.

The above model is designed for binary choice model only. In order to deal with a discrete dependent variable with more than two choices, we have to use a multiple-choice setting. There are two kinds of data in a multiple-choice setting, namely, ordered and unordered. The examples of ordered data are bond rating and the level of insurance coverage. However, in our model, the choices are (1) no preference for the sex of the next child, (2) desired sex of the next child is male (3) and the desired sex of the next child is female. This is an unordered data format. Therefore, we are going to construct an unordered multiple-choice model. With a random utility model, an individual i faced with J choices, we assume his utility function with the choice j as:

$U_{ij} = \beta' \mathbf{X}_{ij} + \varepsilon_{ij}$

where **X** is a vector of independent variables

If an individual i chooses j among the J choices, we assume his utility reaches maximum value. In other words, the utility is highest with the choice j than other choices, such as k.

Prob $(U_{ij} > U_{ik})$ for all other $k \neq j$

Assuming the probability follows a logistic distribution.

$$\text{Prob}(Y_i = j) = \frac{\exp(\beta_j' \mathbf{X}_i)}{\sum_k \exp(\beta_k' \mathbf{X}_i)} \qquad k = 1, 2, 3 \ldots J$$

To estimate the parameters, we put it in log likelihood format.

$$\text{In } L = \sum_{i} \sum_{j=0}^{J} d_{ij} \text{ In Prob}(Y_i = j) \qquad \text{where } j = 1, 2, 3 \ldots J$$

where $d_{ij} = 1$ if $Y_i = j$, $d_{ij} = 0$ if $Y_i = k$, for all $k \neq j$.

Then we have the multinomial logit model. As stated above, the marginal effect of an independent variable is not $\underline{\beta}$, but is $f(\underline{\beta}'\mathbf{X})\ (\underline{\beta}) = f\underline{\beta}$. Both the predicted probabilities, $F(\underline{\beta}'\mathbf{X}) = F_p$, and the estimated marginal effects, $f\underline{\beta}$, where $\underline{\beta}$ is the estimated β in the above log likelihood model, are nonlinear functions of $\underline{\beta}$.

Appendix 3. Different Model Specifications

A.3.1 Model 1

Table A.1a Estimated Results of Model 1 with Different Specifications (1)

Variables	S1		S2$		S3	
	dProb (Y=1)/dx	dProb(Y=2)/dx	dProb (Y=1)/dx	dProb(Y=2)/dx	dProb (Y=1)/dx	dProb(Y=2)/dx
Constant	0.79219	-0.26695	0.79330	-0.25934	0.78767	-0.27688
	(3.88240) ***	(-0.668860)	(3.91106) ***	(-0.615231)	(3.73594) ***	(-0.749273)
Having the first child after 1979 or no child yet					0.00075165 (0.242986)	0.025587 (0.788443)
Difference in the number of sons and daughters	-0.29462 (-13.7647) ***	0.21054 (7.49845) ***	-0.29491 (-13.8008) ***	0.21071 (7.49390) ***	-0.29483 (-13.7153) ***	0.21080 (7.51024) ***
Household without children	-0.067849 (-4.84392) ***	-0.063209 (-2.79246) ***	-0.067820 (-4.84199) ***	-0.063580 (-2.79727) ***	-0.068235 (-4.79534) ***	-0.064374 (-2.83137) ***
Number of children						
Respondent's age	-0.015704 (-0.501534)	0.019815 (1.41793) *	-0.015856 (-0.520940)	0.019568 (1.39179) *	-0.015228 (-0.504321)	0.018586 (1.32150) *
Respondent's age**2	0.00017246 (0.135733)	-0.0003312 (-1.49540) *	0.00017510 (0.153171)	-0.0003279 (-1.47321) *	0.00016304 (0.150046)	-0.0002996 (-1.33600) *
Respondent's husband's age	-0.025122 (-2.28588) **	-0.013227 (-2.00972) **	-0.025052 (-2.28822) ***	-0.013427 (-2.02546) **	-0.025204 (-2.29911) ***	-0.013590 (-2.05051) **
Respondent's husband's age**2	0.00044060 (2.37648) ***	0.00022055 (2.16450) **	0.00043895 (2.37751) ***	0.00022331 (2.17818) **	0.00044163 (2.39165) ***	0.00022816 (2.22141) **
Respondent's education level	-0.0007198 (0.054450)	0.0020673 (1.10063)	-0.0006939 (0.082113)	0.0021759 (1.16629)	-0.0007370 (0.039527)	0.0020242 (1.07339)

(Continued on next page)

Table A.1a - continued

Variables	S1		S2$		S3	
	dProb (Y=1)/dx	dProb(Y=2)/dx	dProb (Y=1)/dx	dProb(Y=2)/dx	dProb (Y=1)/dx	dProb(Y=2)/dx
Respondent's husband's education level	-0.0015354 (-0.149248)	0.0028141 (1.29722) *	-0.0015335 (-0.146236)	0.0028393 (1.30837) *	-0.0015241 (-0.147395)	0.0028007 (1.29301) *
Respondent works in the non-agricultural sector	0.014348 (0.287367)	-0.0020065 (0.036712)	0.014742 (0.299660)	-0.0015730 (0.053270)	0.014667 (0.287016)	-0.0027789 (0.013669)
Respondent's husband works in the non-agricultural sector	0.053105 (1.99605) **	-0.0067055 (0.269368)	0.052176 (1.93370) **	-0.0088578 (0.139463)	0.052995 (1.98688) **	-0.0070672 (0.246693)
Living in city	-0.093908 (-1.12635)	0.072338 (1.49250) *	-0.093646 (-1.11649)	0.073371 (1.52483) *	-0.093839 (-1.12684)	0.071936 (1.47939) *
Living in town	-0.035731 (-1.33852) *	-0.054860 (-1.82494) **	-0.035230 (-1.31929) *	-0.054283 (-1.80255) **	-0.036087 (-1.33388) *	-0.053665 (-1.79208) **
Household annual income	-8.39960D-06 (-1.72267) **	-5.24549D-06 (-1.12330)	-8.39655D-06 (-1.72695) **	-5.33844D-06 (-1.13435)	-8.42475D-06 (-1.71149) **	-5.03973D-06 (-1.08771)
Washing machine	-0.068540 (-0.785606)	0.077436 (2.05200) **	-0.068301 (-0.776899)	0.078156 (2.07534) **	-0.068414 (-0.779220)	0.077890 (2.06487) **
Sewing machine	-0.045989 (-2.54690) ***	-0.0019255 (-0.882263)	-0.046337 (-2.58862) ***	-0.0028490 (-0.954354)	-0.046126 (-2.53471) ***	-0.0011518 (-0.824353)
Refrigerator	-0.29754 (-1.47322) *	0.12508 (0.690932)	-0.29780 (-1.47609) *	0.12476 (0.687218)	-0.29830 (-1.47558) *	0.12718 (0.705969)
Television	0.0085746 (0.866788)	0.035287 (1.87095) **	0.0089456 (0.889511)	0.036016 (1.90829) **	0.0084992 (0.860571)	0.035157 (1.86363) **

(Continued on next page)

Table A.1a - continued

Variables	S1		S2$		S3	
	dProb (Y=1)/dx	**dProb(Y=2)/dx**	**dProb (Y=1)/dx**	**dProb(Y=2)/dx**	**dProb (Y=1)/dx**	**dProb(Y=2)/dx**
Respondent's nationality is Han	0.32307 (2.07321) **	-0.046474 (0.257024)	0.32250 (2.06405) **	-0.047219 (0.245617)	0.32019 (2.06274) **	-0.037862 (0.346696)
Respondent's husband's nationality is Han	-0.24182 (-1.53174) *	0.038006 (-0.156432)	-0.24113 (-1.52508) *	0.037913 (-0.154307)	-0.23896 (-1.52538) *	0.029257 (-0.244849)
Likelihood ratio	1317.456***		1318.47***		1318.072***	
Percent of correct prediction	74.97%		75.10%		74.79%	
Sample size	1670		1671		1670	

Inside the ( ) are t-statistics

*** 1% significant level

** 5% significant level

* 10% significant level

all t-test values are for the estimated β.

S1 is the specification used in the thesis

$ including unmarried women

Table A.1b Estimated Results of Model 1 with Different Specifications (2)

Variables	S4		S5		S6	
	dProb (Y=1)/dx	dProb(Y=2)/dx	dProb (Y=1)/dx	dProb(Y=2)/dx	dProb (Y=1)/dx	dProb(Y=2)/dx
Constant	0.22017	-0.21521	0.74489	-0.27101	0.24241	-0.22157
	(2.42095) ***	(-3.80065) ***	(3.61142) ***	(-0.78011)	(2.94311) ***	(-3.83813) ***
Having the first child after 1979 or no child yet						
Difference in the number of sons and daughters	-0.28511 (-13.5072) ***	0.20342 (7.43704) ***	-0.29184 (-13.7390) ***	0.20643 (7.44106) ***	-0.29173 (-13.7042) ***	0.20949 (7.43026) ***
Household without children	-0.017100 (-1.68848) **	-0.096176 (-3.27148) ***	-0.067168 (-4.91924) ***	-0.068409 (-2.96795) ***	-0.049200 (-4.19636) ***	-0.065625 (-2.74976) ***
Number of children	0.023286 (0.676624)	-0.022715 (-1.35901) *				
Respondent's age	-0.0029925 (-0.800767)	0.0013639 (0.317118)	-0.016076 (-0.538254)	0.019517 (1.39416) *	-0.0026768 (-0.800634)	0.00058419 (0.196095E-02)
Respondent's age**2			0.00016987 (0.136477)	-0.0003250 (-1.47652) *		
Respondent's husband's age	0.00035661 (0.311677)	0.0011807 (0.654417)	-0.018257 (-1.78435) **	-0.013208 (-1.81691) **	0.00057421 (0.361325)	0.00095140 (0.564623)
Respondent's husband's age**2			0.00034386 (1.96348) **	0.0002219 (1.99786) **		
Respondent's education level	-0.0006903 (0.112023)	0.0023661 (1.29810) *	-0.0007904 (0.078678)	0.0023782 (1.27997)	-0.00087486 (0.011624)	0.0021980 (1.17473)

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Table A.1b - continued

Variables	S4		S5		S6	
	dProb (Y=1)/dx	dProb(Y=2)/dx	dProb (Y=1)/dx	dProb(Y= 2)/dx	dProb (Y=1)/dx	dProb(Y=2)/dx
Respondent's husband's education level	-0.0021051 (-0.297038)	0.0033509 (1.53718) *	0.00007102 (0.523645)	0.0029368 (1.58645) *	-0.0019799 (-0.311906)	0.0029079 (1.31697) *
Respondent works in the non-agricultural sector			0.027519 (0.601159)	0.0030675 (0.295464)		
Respondent's husband works in the non-agricultural sector			0.044645 (1.70817) **	-0.0044726 (0.288849)		
Living in city	-0.060443 (-0.650315)	0.071073 (1.93887) **	-0.11747 (-1.46687) *	0.082423 (1.67863) **	-0.062025 (-0.709478)	0.065390 (1.70745) **
Living in town	-0.019127 (-1.05177)	-0.062081 (-1.99352) **	0.070637 (-2.17488) **	-0.052370 (-2.03513) **	-0.024514 (-1.16534)	-0.059947 (-1.96016) **
Household annual income	-8.44941D-06 (-1.46753) *	-1.01222D-06 (-0.466095)	-0.00001307 (-2.37184) ***	-2.46687D-06 (-0.89243)	-7.59938D-06 (-1.62604) *	-5.75843D-06 (-1.18060)
Washing machine	-0.053653 (-0.416253)	0.088750 (2.72448) ***	-0.066882 (-0.675958)	0.087854 (2.48694) ***	-0.057931 (-0.580334)	0.077653 (2.22139) **
Sewing machine	-0.041034 (-2.23682) **	0.00051030 (-0.611794)			-0.043339 (-2.36750) ***	-0.0003802 (-0.721906)
Refrigerator					-0.28319 (-1.37809) *	0.12922 (0.778488)
Television					0.012909 (1.00858)	0.034002 (1.85965) **

(Continued on next page)

Table A.1b - continued

Variables	S4		S5		S6	
	dProb (Y=1)/dx	**dProb(Y=2)/dx**	**dProb (Y=1)/dx**	**dProb(Y= 2)/dx**	**dProb (Y=1)/dx**	**dProb(Y=2)/dx**
Respondent's nationality is Han	0.25588 (1.48853) *	-0.037632 (0.180278)			0.27007 (1.56328) *	-0.046928 (0.114820)
Respondent's husband's nationality is Han	-0.18310 (-1.06125)	0.025339 (-0.143803)			-0.20123 (-1.14511)	0.039489 (-0.040286)
Likelihood ratio	1293.638***		1291.45***		1298.02***	
Percent of correct prediction	74.25%		74.85%		74.55%	
Sample size	1670		1670		1670	

Inside the ( ) are t-statistics

*** 1% significant level

** 5% significant level

* 10% significant level

all t-test values are for the estimated β.

Corresponding "Hit and Miss" Tables for the 6 Specifications

Table A.2a **S1**

		Actual			Total
		0	1	2	
	0	38	28	12	78
Predicted	1	196	928	14	1138
	2	107	61	286	454
Total		341	1017	312	1670

Percent of correct prediction: **74.97%**

Table A.2b **S2**

		Actual			Total
		0	1	2	
	0	39	27	11	77
Predicted	1	196	929	14	1139
	2	107	61	287	455
Total		342	1017	312	1671

Percent of correct prediction: **75.10%**

Table A.2c **S3**

		Actual			Total
		0	1	2	
	0	38	28	15	81
Predicted	1	196	928	14	1138
	2	107	61	283	451
Total		341	1017	312	1670

Percent of correct prediction: **74.79%**

Table A.2d **S4**

		Actual			Total
		0	1	2	
Predicted	0	31	34	13	78
	1	202	923	13	1138
	2	108	60	286	454
Total		341	1017	312	1670

Percent of correct prediction: **74.25%**

Table A.2e **S5**

		Actual			Total
		0	1	2	
Predicted	0	29	23	14	66
	1	205	933	10	1148
	2	107	61	288	456
Total		341	1017	312	1670

Percent of correct prediction: **74.85%**

Table A.2f **S6**

		Actual			Total
		0	1	2	
Predicted	0	29	32	10	71
	1	203	926	12	1141
	2	109	59	290	458
Total		341	1017	312	1670

Percent of correct prediction: **74.55%**

A.3.2 Model 2

Table A.3a Results of Model 2 with Different Specifications (1)

Variables	S1$	S2#	S3	S4
Constant	2.55853	2.46104	2.42392	2.37844
	(7.46372)	(7.48833)	(7.39309)	(7.31752)
	***	***	***	***
Having the first child after 1979	-0.121798	-0.108901	-0.128605	-0.125832
	(-0.928237)	(-0.846534)	(-0.986217)	(-0.968953)
Number of children	-0.207119	-0.203498	-0.204153	-0.197316
	(-4.50735)	(-4.60696)	(-4.46611)	(-4.34347)
	***	***	***	***
Respondent's age when the first child was born	0.018271	-0.920880E-03	-0.015367	-0.018579
	(0.321437)	(-0.016486)	(-0.985840)	(-1.19250)
Respondent's age when the last child was born	-0.050985	-0.032161	-0.025367	-0.024469
	(-0.901843)	(-0.578269)	(-2.19838)	(-2.12733)
			**	**
Respondent's husband's age when the first child was born	-0.036684	-0.017045		
	(-0.642825)	(-0.303814)		
Respondent's husband's age when the last child was born	0.026015	0.730350E-02		
	(0.454422)	(0.129724)		
Respondent works in the non-agricultural sector				
Respondent's husband works in the non-agricultural sector				
Respondent's education level	-0.177723E-02	-0.803592E-02	-0.293144E-02	-.405718E-02
	(-0.153671)	(-0.705232)	(-0.254129)	(-0.355265)
Respondent's education level**2				
Respondent's husband's education level	-0.020510	-0.019694	-0.018036	-0.017786
	(-2.27852)	(-2.23512)	(-2.00446)	(-1.97414)
	**	**	**	**
Respondent's husband's education level**2				
Local representatives asked about children	-0.109835	-0.093802	-0.113742	
	(-1.86982)	(-1.62573)	(-1.94094)	
	**	*	**	

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Table A.3a - continued

Variables	S1$	S2#	S3	S4
Respondent lived in city in her childhood	2.55853	2.46104	2.42392	2.37844
	(7.46372)	(7.48833)	(7.39309)	(7.31752)
	***	***	***	***
Respondent lived in town in her childhood	0.198547	0.215590	0.206581	
	(0.841352)	(0.929535)	(0.875882)	
Respondent's husband lived in city in his childhood	-0.175712	-0.185676	-0.128218	
	(-1.19730)	(-1.30848)	(-0.860458)	
		*		
Respondent's husband lived in town in his childhood	0.190281	0.098680	0.195761	
	(0.845750)	(0.444757)	(0.868578)	
Living in city	-0.050453	-0.819895E-02	-0.072420	-0.177261
	(-0.303334)	(-0.050229)	(-0.436153)	(-1.26427)
Living in town	-0.461540	-0.228480	-0.468631	-0.292196
	(-2.17144)	(-1.05464)	(-2.19932)	(-1.72371)
	**		**	**
Household monthly income				
Household annual income	0.512548E-04	0.560345E-04	0.487304E-04	0.508284E-04
	(1.98492)	(2.21536)	(1.90849)	(1.98298)
	**	**	**	**
Building material of house: Concrete				
Building material of house: Brick				
Washing machine	0.046956	0.030315	0.044773	0.675486E-02
	(0.377056)	(0.246625)	(0.359261)	(0.055211)
Sewing machine	0.042169	0.044335	0.031616	0.043731
	(0.651621)	(0.698317)	(0.488309)	(0.678682)
Refrigerator	-0.382655	-0.369688	-0.386184	-0.399080
	(-1.43089)	(-1.38037)	(-1.45284)	(-1.52498)
	*	*	*	*
Television	-0.099838	-0.094227	-0.088533	-0.093250
	(-1.26292)	(-1.20639)	(-1.11280)	(-1.17471)
Respondent's nationality is Han	-0.296958	-0.074261	-0.285615	-0.273392
	(-0.712237)	(-0.182606)	(-0.687327)	(-0.669923)

(Continued on next page)

Table A.3a - continued

Variables	S1$	S2#	S3	S4
Respondent's husband's	0.359600E-02	-0.167940	0.021194	0.023425
nationality is Han	(0.838445E-02)	(-0.401032)	(0.049619)	(0.056023)
Household living with elderly	-0.177650	-0.158956	-0.166485	-0.164974
parents	(-2.25734)	(-2.08372)	(-2.13947)	(-2.11814)
	**	**	**	**
Interactive variables				
(Respondent's education level)	-0.038416	-0.031626	-0.036687	-0.036541
* (Having the first child after	(-2.49893)	(-2.09171)	(-2.39115)	(-2.38792)
1979)	***	**	***	***
(Respondent's husband's	0.044195	0.040991	0.043208	0.041485
education level) * (Having the	(2.73791)	(2.59654)	(2.68079)	(2.57179)
first child after 1979)	***	***	***	***
Adjusted R-squared	0.037853	0.036172	0.037320	0.035954
F-statistic (zero slopes)	6.37568***	6.35026***	6.77801***	8.10252***
Sample size	3417	3565	3429	3429

Inside the ( ) are t-statistics

*** 1% significant level

** 5% significant level

* 10% significant level

S1 is the specification used in the thesis

$ Excluding those observations where there are errors in the data of ages of husband when they have their first and last children

Including observations whom have remarriage.

Table A.3b Results of Model 2 with Different Specifications (2)

Variables	S5	S6	S7
Constant	2.12454	2.11368	0.574131
	(6.32143)	(7.08689)	(1.95134)
	***	***	**
Having the first child after 1979	-0.062990	0.049609	0.380805
	(-0.490079)	(0.667856)	(5.46437)
			***
Number of children	-0.262751	-0.193726	
	(-7.63782)	(-4.28673)	
	***	***	
Respondent's age when the first child was born	-0.038606	-0.018847	-0.92717E-02
	(-3.25733)	(-1.20728)	(-0.790823)
	***		
Respondent's age when the last child was born		-0.023191	
		(-2.01934)	
		**	
Respondent's husband's age when the first child was born			
Respondent's husband's age when the last child was born			
Respondent works in the non-agricultural sector	0.051755		0.111083
	(0.362453)		(0.773063)
Respondent's husband works in the non-agricultural sector	0.088211		0.104501
	(1.10040)		(1.26258)
Respondent's education level	-0.56663E-02	0.013766	0.700685E-02
	(-0.487335)	(0.590334)	(0.292215)
Respondent's education level**2		-0.331129E-02	-.0.266125E-02
		(-1.42486)	(-1.11788)
		*	
Respondent's husband's education level	0.017825	-0.040309	-0.023846
	(-1.97002)	(-2.10758)	(-1.24150)
	**	**	
Respondent's husband's education level**2		0.277214E-02	0.201432E-02
		(1.76266)	(1.27389)
		**	

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Table A.3b - continued

Variables	S5	S6	S7
Local representatives asked about children	0.100286		0.035176
	(1.71065)		(0.589807)
	**		
Respondent lived in city in her childhood			-0.131100
			(-0.774602)
Respondent lived in town in her childhood			0.292387
			(1.21501)
Respondent's husband lived in city in his childhood	-0.211811		-0.086616
	(-1.44513)		(-0.558560)
	*		
Respondent's husband lived in town in his childhood	0.217987		0.150595
	(0.977524)		(0.676511)
Living in city	-0.201760	-0.150940	-0.157081
	(-1.14811)	(-1.08228)	(-0.869162)
Living in town	-0.433964	-0.229347	-0.515477
	(-2.16093)	(-1.40696)	(-2.32529)
	**	*	**
Household monthly income	0.471186E-03		0.382073E-03
	(1.58937)		(1.40223)
	*		*
Household annual income	0.180058E-04	0.558244E-04	0.339742E-05
	(0.592885)	(2.22577)	(0.115203)
		**	
Building material of house: Concrete	0.065751		0.097145
	(0.353939)		(0.524506)
Building material of house: Brick	-0.089831		-0.074509
	(-0.526880)		(-0.437921)
Washing machine	0.014866	-0.744637E-02	0.038726
	(0.114200)	(-0.060605)	(0.292761)
Sewing machine	0.029890	0.035643	-0.035834
	(0.461510)	(0.554413)	(-0.544064)
Refrigerator	-0.423889	-0.399163	-0.318471
	(-1.61177)	(-1.55021)	(-1.17720)
	*	*	

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Table A.3b - continued

Variables	S5	S6	S7
Television	-0.102233	-0.082551	-0.049885
	(-1.28596)	(-1.02918)	(-0.612014)
	*		
Respondent's nationality is Han	-0.257215		-0.224259
	(-0.619064)		(-0.535018)
Respondent's husband's nationality is Han	0.021424		0.133634
	(0.050336)		(0.311455)
Household living with elderly parents	-0.169434	-0.173573	-0.165025
	(-2.17552)	(-2.22614)	(-2.10946)
	**	**	**
Interactive variables			
(Respondent's education level) * (Having the first child after 1979)	-0.034843		
	(-2.27858)		
	**		
(Respondent's husband's education level) * (Having the first child after 1979)	0.040675		
	(2.52548)		
	***		
Adjusted R-squared	0.035431	0.034633	0.624971E-02
F-statistic (zero slopes)	6.03675***	8.68635***	1.82918***
Sample size	3429	3429	3429

Inside the ( ) are t-statistics

*** 1% significant level

** 5% significant level

* 10% significant level

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